RECORDS

of the

INDIAN MUSEUM

(A JOURNAL OF INDIAN ZOOLOGY)

Vol. I, 1907.

EDITED BY

THE SUPERINTENDENT,

INDIAN MUSEUM, NATURAL HISTORY SECTION.

Calcutta:

PUBLISHED BY ORDER OF THE TRUSTEES OF THE INDIAN MUSEUM.

BAPTIST MISSION PRESS.

1907.

CONTENTS.

PART I, JUNE.

PART II, AUGUST.

PART III, OCTOBER.

PART IV, DECEMBER.

LIST OF PLATES.

LIST OF AUTHORS.

Annandale, N., B.A., D.Sc.	The Fauna of Brackish Ponds at Port Canning, Lower Bengal: Part I, p. 35; Part III, p. 47; Part IV, p. 139; Part VI, p. 197.—The appendicular skeleton of the Dugong, p. 79.—Melanic specimens of *Barbus ticto*, p. 81.—Two barnacles new to Indian Seas, p. 81.—Mosquitoes from Kumaon, p. 83.—Peculiar habit of an Earthworm, p. 83.—Further note on a Polyzoon from the Himalayas, p. 145.—Reports on a collection of Batrachia, Reptiles and Fish from Nepal and the Western Himalayas, Introductory note, p. 149, and Lacertilia, p. 151.—The occurrence of *Gecko verticillatus* in Calcutta, p. 171.—The distribution of *Kachuga sylhetensis*, p. 171.—The distribution of *Bufo andersoni*, p. 171.—An enemy of certain Pearl Oysters in the Persian Gulf, p. 176.—The distribution in India of the African Snail, *Achatina fulica*, p. 176.—Statoblasts from the surface of a Himalayan Pond, p. 177.—Notes on Freshwater Sponges, Nos. I—V, p. 267; Nos. VI, VII, p. 387.—Eggs of *Tylototriton verrucosus*, p. 278.—The hosts of *Tachæa spongillicola*, p. 279.—A second species of *Dichelaspis* from *Bathynomus giganteus*, p. 279.—A colour variety of *Typhlops braminus*, p. 397.—Reptiles and a Batrachian from an island in the Chilka Lake, Orissa, p. 397.
Boulenger, G. A., F.R.S.	Reports on a collection of Batrachia, Reptiles and Fish from Nepal and the Western Himalayas, Batrachia, p. 149.—Description of a New Snake from Nepal, p. 217.
Brunetti, E.	Revision of the Oriental Stratiomyidæ, p. 85.—Notes on Oriental Diptera, Nos. I and II, p. 163; No. III, p. 211; No. IV, p. 381.—Note on *Rutilia nitens*, p. 172.—Annotated Catalogue of Oriental Culicidæ, p. 297.
Burr, Malcolm, B.A., F.Z.S.	A third note on Earwigs (Dermaptera) in the Indian Museum, with the description of a new species, p. 207.

ERRATA AND CORRIGENDA.

Page 22, line 24. *Elide* "var. *sculptus*" *after* "*Chydorus globosus*, Baird."

,, 26, line 5. *For* "*Thyocryptus*" *read* "*Ilyocryptus*."

,, 39, line 6 from foot of page. *For* "*schulizei*" *read* "*schultzei*."

,, 52, line 4. *For* "fig. 5" *read* "fig. 3."

,, 69, line 11 from foot of page, and page 82, line 8 from foot of page. *For* "0·22" *read* "1·2."

Plate iv, below figures. *For* "*Sagartia schilleriana*" *read* "*Metridium schillerianum*."

Page 80, line 13. *For* "used" *read* "fused."

,, 100, footnote, and page 132, line 2. *For* "*Acanthina argentea*" *read* "*Acanthina argentihirta*."

,, 145, line 7, page 146, line 11, page 147, lines 4 and 17 from foot of page, and page 148, lines 20, 21 and 29. *For* "*Lophopus ledenfeldi*" *read* "*Lophopus lendenfeldi*."

,, 148, line 21. *For* "*indica*" *read* "*himalayanus*."

,, 148, last line. *Before* "lacks" *intercalate* "often."

,, 176, line 19. *For* "Evans" *read* "Galletly."

,, 337, line 20. *For* "*Hulecœtomyia*" *read* "*Hulecœteomyia*."

,, 356, line 28. *Change* "♂" *to* "♀."

,, 362, line 27. *For* "p. 80" *read* "p. 110."

,, 385, line 6. *Add* "of Anthomyia" *after* "species."

INDEX.

[*N.B.*—An asterisk (*) preceding a line denotes a new variety; a dagger (†) indicates a new species; and a double-dagger (‡), a new genus: synonyms are printed in Italics with page numbers in bold-faced type.]

D

[1] Originally *Macrothrix tenuicornis*: see p. 176.

N

U

CONTRIBUTIONS TO THE FAUNA OF THE ARABIAN SEA, WITH DESCRIPTIONS OF NEW FISHES AND CRUSTACEA.

By R. E. LLOYD, *M.B., B.Sc., Capt. I.M.S., Surgeon Naturalist, Marine Survey of India.*

During the early part of 1906, the Indian Marine Survey Ship 'Investigator' proceeded from Muscat to Aden along the south coast of Arabia and returned by the same route. On both passages the trawl was used almost every day, so that ten hauls were obtained, three from less than 200 fathoms, and seven from about 500 fathoms or over. The results were for the most part good. Since this is the first time that the 'Investigator' or, I believe, any other ship has trawled in deep water along this coast, it seems well to publish a general account of the material obtained. So far it has only been possible to identify the Fish and Crustacea, but the greater part of the specimens fall within these two groups. The identification of species has been facilitated by the fine collection of types of Indian deep-sea Fish and Crustacea in the Indian Museum, Calcutta.

On the present collection, as a whole, the following observations may be made, and it is in these that its chief interest seems to lie :—

I. The number of new species met with is remarkably small considering that the ground was being investigated for the first time. Only two new Crustacea and five new Fish, all species of well-known genera, were obtained. Of these seven species five are from the three stations in less than 200 fathoms, while the seven stations in about 500 fathoms or over only contributed two new species, one Fish and one Crustacean.

II. The repeated occurrence of many of the species at several different stations is remarkable. Thus, of the seven deeper stations, one fish, *Bathygadus furvescens*, was found at four, while several species were found at three, although the seven stations were distributed irregularly along a line 1,000 miles or more in length.

III. The occurrence of the giant Isopod *Bathynomus giganteus* and the large bilaterally symmetrical Hydroid *Branchiocerianthus imperator* (which is here recorded from Indian seas for the first time) is noteworthy.

The details of the various stations are as follows :—

STATION No. 355.

Depth 492 fathoms. Lat. 21° 49 50″ N. Long. 59° 48′ 00″ E. Surface temperature 78° F. Bottom, green sandy mud with many Foraminifera.

The trawl came up with the iron beam bent nearly double and the net badly torn; in spite of this many things were obtained from the swabs and from the extreme end of the bag, which was intact.

FISH.

None obtained; any caught must have escaped.

CRUSTACEA.

Glyphocrangon investigatoris ..	(Three typical specimens).
Munida andamanica ..	(Several specimens. The spines at the side of the rostrum are about one-third of the length of the rostrum, *i.e.*, rather shorter than in the type; but this character is very variable).
Munidopsis trifida ..	(Several specimens).
,, *scobrina* ..	(Several specimens).
,, *spinihirsuta*, sp. n.	(Three small males. Described *postea*, p. 12).
Nematocarcinus cursor ..	(Several specimens).
Aristeus crassipes ..	(Two specimens).
Aethusa indica ..	(One specimen).

Entangled in the net were two specimens of a most beautifully reddish orange Hydroid, which were found to agree almost exactly with the form figured by Merk and subsequently by Miyajima, who named it *Branchiocerianthus imperator*. Similar specimens were subsequently obtained in deep water off the coast of Baluchistan; these will be more fully described elsewhere.

At this station a large number of Polychætes were obtained. Among them were representatives of the Chlorohæmid genera *Trophonia* and *Brada*, two Polynoids (one of which was a large blood-red species about three inches long) and a small Terebellid. A Eunicid contained in a branched parchment tube with openings at regular intervals was also present, and to this tube a colony of *Epizoanthus* was attached.

Besides these forms several bivalve Molluscs of the genus *Nucula*, probably *N. fultoni*, were taken, and the Asterid *Mediaster*, five species of Ophiurids and some Gorgonacea.

STATION No. 356.

Depth 156—200 fathoms. Lat. 17° 59′ 00″ N. Long. 57° 22′ 30″ E. Bottom temperature 58° F. Surface temperature 77° F. Bottom probably firm, hard sand; no sample was obtained in the sounding tube and the specimens in the trawl were all quite clean.

FISH.

Cynoglossus carpenteri	..	(Seven specimens of this Sole. They were distinctly bathybial in appearance, being of a very dark sepia colour and of a flabby consistency).

CRUSTACEA.

Paralia alcocki	..	(Over fifty specimens, including two giant males).

Many specimens of the Molluscs *Rostellaria delicatula* and *Pirula investigatoris.* These specimens are generally found together and have been met with several times in the Bay of Bengal and off the West Coast of India, always from about the 200-fathom line.

A small Eunicid in a sandy tube was also obtained.

STATION No. 357.

Depth 555 fathoms. Lat. 16° 51′ 00″ N. Long. 54° 55′ 00″ E. Bottom temperature 48·5° F. Surface temperature 78° F. Bottom, finely divided greenish mud.

FISH.

Lamprogrammus fragilis	..	(One specimen).
Bathygadus furvescens	..	(One specimen).

CRUSTACEA.

Nephropsis stewartii	..	(One specimen).
Aristeus crassipes	..	(Three specimens).
Sergestes bisulcatus	..	(One specimen).
Lyreideus channeri	..	(One specimen).

Besides these species the following Polychætes were obtained :—two large specimens of *Hyalinœcia tubicola*, the tubes of which were about 10 inches in length, and an interesting genus which comes under the group Sigalionima and is perhaps *Thalanessa.* Its most remarkable features are a pair of large pink eyes and a median tentacle on the extensible proboscis. Also two small blood-red Polynoids, which were embedded in the outer skin of an Elasipod Holothurian. Also several large *Dentalia*, probably *D. magnificum* ; the empty shells of a species of *Cryptodon* ; a species of *Phormosoma*, and a Pennatulid with a quadrangular rachis bearing polyps on one side only.

STATION No. 358.

Depth 585 fathoms. Lat. 15° 55′ 30″ N. Long. 52° 38′ 30″ E. Bottom temperature 47·5° F. Surface temperature 77° F. Bottom, green sandy mud.

FISH.

Lamprogrammus fragilis	..	(Three specimens).
Bathygadus furvescens	..	(Two specimens).
Benthobatis moresbyi	..	(One small specimen of this interesting bathybial Torpedo, which is now found for the third time).

CRUSTACEA.

Bathynomus giganteus	..	(Two specimens, a female 7 inches long and a male 4 inches; generative apparatus was not present in either specimen. The female had undeveloped oöstegites to the thoracic legs. Both specimens were alive when taken from the trawl. The pleopods were covered with a small Barnacle described by Annandale under the name *Dichelaspis bathynomi* [*Ann. Mag. Nat. Hist.*, ser. 7, vol. xviii, July, 1906].)
Aristeus crassipes	..	(One specimen).
Acanthephyra armata	..	(One specimen).
Pandalus (*Plesionika*) *martius*		(One incomplete specimen).
Munida militaris	..	(Several specimens).
Nephropsis ensirostris	..	(One specimen).
Scalpellum bengalense	..	(Several specimens).

Many other species were obtained at this station, *e.g.*, Asterids of the genera *Persephonaster* and *Zoroaster*, with portions of a *Brisinga* including two central disks showing facets for sixteen arms. Also representatives of the Echinoid genera *Phormosoma* and *Cidaris* or allied genera. Also the Molluscs *Amussium* and *Cryptodon* and a shell-less Tectibranchiate form probably belonging to the genus *Neda*; Holothurians of the genus *Ankyroderma*; and a large quantity of a thin parchment-like tubing having the calibre of a crow's quill and bearing occasional side branches. These tubes contained an interesting little Polychæte of a dark green colour and resembling *Chætopterus* in its general form, but bearing two long white cephalic tentacles. Most probably it comes into the genus *Phyllochætopterus*.

STATION No. 359.

Depth 674 fathoms. Lat. 14° 41′ 30″ N. Long. 50° 33 15″ E. Bottom temperature 47·2° F. Surface temperature 78° F. Bottom, green mud.

A poor result. One fine specimen of the Prawn *Acanthephyra armata*: the Molluscs *Amussium* and *Solenomya*; the Holothurian

Ankyroderma: the Polychætes *Hyalinœcia tubicola* and an interesting form with over one hundred segments all bearing elytra. This is probably a species of *Sigalion.*

STATION No. 360.

Depth 130 fathoms. Lat. 13° 36′ 00″ N. Long. 47° 32′ 00″ E. Temperature not taken. Bottom probably firm sand; no sample obtained in the tube and all the specimens quite clean.

Fish.

A good haul containing four new species.

Raia philipi, sp. n. ..	(One small male. Described in *Ann. Mag. Nat. Hist.*, ser. 7, vol. xviii, Oct. 1906).
Uranoscopus crassiceps ..	(Four specimens).
Peristethus adeni, sp. n. ..	(One specimen. Described *postea*, p. 8).
Bregmaceros macclellandi ..	(One specimen).
Lophius lugubris ..	(Three specimens).
,, *indicus* ..	(One specimen).
Bembrops caudimacula ..	(Many specimens. These are slightly unlike the type; the eye is relatively smaller and the cutaneous appendages on the lower end of the maxilla are longer).
Callionymus carebares ..	(Many specimens).
Narcine mollis, sp. n. ..	(Two specimens. Described *postea*, p. 8).
Solea umbratilis ..	(Many specimens. These seem darker in colour than the type and the skin feels rougher owing to the spinelets which project over the posterior border of the scales being somewhat stronger and more prominent).
Læops nigrescens, sp. n. ..	Many specimens. Described *postea*, p. 9).
Lepidotrigla spiloptera var. *longipennis* ..	(Many specimens).

Crustacea.

Only three species, but the numbers obtained were very large.

Palinurus angulatus ..	(Seventy-five of these Crayfish were taken. They made a loud creaking noise with their sound-producing apparatus as the net was hauled in).

Arctus orientalis	..	(Forty-five specimens).
Mursia bicristimana	..	(Twenty-five specimens).

The Molluscan genera *Persona* and *Pirula* (a species of the latter closely allied to *P. investigatoris*) and the Nudibranch *Pleurophyllidea* were represented. Also the Echinoderm genera *Cidaris*, *Clypeaster* and *Zoroaster*; and the Pennatulids *Veretillum*, *Umbellularia*, and *Pennatula*, all in great numbers.

STATION No. 361.

Depth 540 fathoms. Bottom temperature 51·5° F. Surface temperature 82° F. Bottom, green mud.

Another good result.

FISH.

Macrurus macrolophus	..	(One specimen. Almost typical but differs from the type in two respects: (*a*) the spinelets on the scales are longer, (*b*) the barbels are minute. These two characters, the reduction of the barbels and the increase of the spinelets, are the principal features which separate *M. macrolophus* from *M. investigatoris*. This specimen goes somewhat further along the same line of variation).
Dicrolene intronigra	..	(One specimen).
Xenomystax trucidans	..	(One specimen).
Bathygadus furvescens	..	(Two specimens).
Saurenchelys tæniola	..	(One specimen).
Diplacanthopoma squamiceps .. sp. n.	..	(Two specimens. Described *postea*, p. 10).
Lamprogrammus fragilis	..	(Two specimens).

CRUSTACEA.

Glyphocrangon investigatoris	..	(Two specimens).
Lyreideus channeri	..	(Two specimens).
Pentacheles phosphorus	..	(One specimen).
Pandalus alcocki	..	(Many specimens).
Aristeus semidentatus	..	(One specimen).
Homola megalops	..	(Many specimens).
Aethusa indica	..	(Five specimens).
Nephropsis stewartii	..	(One specimen).
Munidopsis wardeni	..	(Many specimens).
Munida andamanica	..	(Three specimens).

The Echinoderm genera *Zoroaster* and *Phormosoma* are represented. Also the Mollusc *Verticordia eburnea* and a species of the Cephalopod genus *Cirrotheuthis.*

STATION No. 362.

Depth 480 fathoms. Lat. 13° 50′ 00″ N. Long. 48° 18′ 00″ E. Bottom temperature 55° F. Surface temperature 79° F. Bottom, green sandy mud.

Fish.

Macrurus macrolophus .. (One specimen).
Bathygadus furvescens .. (Two specimens).

Crustacea.

Homola megalops .. (Three specimens).
Lyreideus channeri .. (One specimen).

Besides these, the Holothurian *Ankyroderma,* some Polychætes of the same species as were obtained at Station No. 357 (*Thalenessa* sp.), and several empty shells belonging to the genera *Cryptodon, Dentalium, Pleurotoma* (three species), *Solariella* and *Velutina.*

STATION No. 363.

Depth 810 fathoms. Lat. 14° 28′ 45″ N. Long. 50° 0′ 15″ E. Bottom temperature 43° F. Surface temperature 80° F. Bottom, green mud with many shells.

Crustacea.

Aristeus crassipes.

Also the Holothurian *Ankyroderma* and the Polychætes *Hyalinœcia tubicola, Phyllochætoptorus* sp., and *Thalenessa* sp., the two latter belonging to the species obtained before. A large Schizonemertine, most probably of the genus *Cerebratulus,* was also taken.

STATION No. 364.

Depth 110 fathoms. Lat. 15° 8′ 30″ N. Long. 51° 52′ 15″ E. Bottom temperature 63·5° F. Surface temperature 80° F. Bottom, sandy mud.

Crustacea.

Squilla investigatoris, sp. n. .. (Over five hundred specimens of this new species were the principal feature of this haul. Described *postea,* p. 10).

Also the Mollusc *Pirula investigatoris* and Pennatulids of the genera *Veretillum, Lituaria* and *Virgularia.*

DESCRIPTIONS OF NEW SPECIES.

FISH.

Peristethus adeni, sp. nov.

Br.r. 7 | a.D. 7 | p.D. 14 | v. 5 | P. 12 2 | L.L. 24 | L.tr. 4 | A. 14 |

The length of the præorbital process is equal to one-third of the distance between its extremity and the anterior border of the orbit. The præocular ridge has a prominent, finely serrated border ; it ends behind in a sharp spine, which is nearly as long as the eye. The inner borders of the præorbital processes are parallel, their outer borders, if prolonged, would meet in front at an angle of 40°. The præorbital processes therefore appear to converge. The length of each labial tentacle is equal to the width of the mouth.

The osseous plates between the ventral fins are unusually thick. The greatest length of each anterior ventral plate is equal to the greatest breadth of both combined. The greatest length of the posterior ventral plates is half that of the anterior ones. The greatest length, in both cases, is to one side of the middle line. A quadrangular portion of the posterior plates fits into a corresponding hiatus in the anterior plates. Throughout the length of the body, on either side, there are four rows of plates, each with a large spine shaped somewhat like a rose-thorn, their points curving backwards. The lowest row is much less conspicuous than the others.

There are large postorbital, occipital, post-temporal, and two opercular spines, a small upper and a large lower one, on either side. There is one small median spine, an orbit's length in front of the orbits.

The greatest height is one-fifth the total length. Total length of the single specimen 6½ inches : greatest length of the head three inches.

Colour—Reddish yellow ; pectorals grey ; dorsals tipped with black.

Habitat—Gulf of Aden ; 130 fathoms.

Narcine mollis, sp. nov.

The vent is slightly nearer the anterior margin of the snout than the tip of the tail. The disc is evenly rounded, it is slightly broader than long. The margin of the flap formed by the confluent nasal valves is most prominent at the sides, unlike *N. timlei*, the other Indian species. The whole quadrangular space which lies between the two nasal clefts is nearly as long as it is broad. In *N. timlei* this space is three times as broad as it is long.

The anterior dorsal is slightly smaller than the posterior ; it commences just behind the ventrals. The dorsal and caudal fins have blunt pointed ends and the folds of skin along the sides of the tail are obvious, but not prominent. The dorsal and ventral parts of the caudal fin are confluent.

The teeth are in 10 to 12 rows in both jaws; the front row has only 3 or 4 teeth; behind this the number gradually increases in succeeding rows up to about 16. The teeth of the front rows have triangular, flat surfaces; behind, the teeth bear a sharp median cusp.

The spiracle is immediately behind the eye and is the same size as the eye.

The electric organs seem well developed. The fish gave no perceptible shock to the hand and died soon after capture.

Round the margin of the disc, and along the sides of the tail, and over the snout, are the openings of mucous pores symmetrically arranged.

Consistency and general appearance distinctly bathybial.

Colour—Dark brown above, greyish brown below.

Habitat—Gulf of Aden; 130 fathoms.

Læops nigrescens, sp. nov.

D. 95 | A. 82 C. 17. | P.d. & 5.13. | V.d. & s. 6.

This species is closely allied to *L. guentheri* and *L. parviceps*. It differs from these in the following respects:—

It is bathybial in appearance. The pectoral fins are longer than the head. The head is $\frac{1}{4}$th the length without the caudal fin; the height without the fins is $2\frac{2}{3}$ in the total length. The pectoral fins are better developed on the left side; the length of the left pectoral is longer than the entire head in most specimens; it is never less than the length of the head. The left pectoral fin is much longer than the right, in some specimens nearly twice as long. The ventral fins are about equal: the left is in a line with the anal. The caudal fin is pointed, its length is 6 in the total. The length of the dorsal and anal fin rays are about equal and are about $2\frac{1}{2}$ in the body height. The lateral line forms a strong pectoral curve; the scales are small and deciduous. The snout is half the major diameter of the eye, the lower eye is in advance of the upper; the eyes are separated by a prominent ridge.

The major diameter of the eye is one-third the length of the head.

Teeth on the blind side only.

Vomer prominent, devoid of teeth.

Seven specimens, the longest $6\frac{3}{4}$ inches in length.

Colour—Left side dark sepia, with irregular patches of a darker sooty tone, fins nearly black. The colour resembles that of *Læops macropthalmatus* from 100 fathoms and differs widely from that of *L. guentheri* and *L. parviceps* from shallow water.

Habitat—Gulf of Aden; 130 fathoms.

Diplacanthopoma squamiceps, sp. nov.

Corresponds with the generic definition in the following respects :—the form and arrangement of the fins, of the teeth and the gills, in the number of the branchiostegals (8), in the absence of pseudobranchiæ and pyloric cæca, in the obscurity of the lateral line, and in the presence of radiating spines on the opercles. It differs from all known species in this important respect :—there are scales on the head as far forward as the posterior limit of the eyes and on the opercles and sides of the head as far forward as a line dropped vertically from the posterior border of the eyes. The head is much depressed and the eyes are close together and look upwards to a great extent, being separated by less than their diameter ; this gives the head a very different appearance from that of the other three known Indian species of the genus, in all of which the eyes are separated by about $1\frac{3}{4}$ times their diameter.

There are deep mucus pits on the head and in a semicircle below the orbits.

There are no pseudobranchiæ, but in the position of these organs there are two very short and slender filaments which are vestiges of this organ. I find that the type specimens of *D. riversandersoni* and *D. raniceps* have precisely similar vestiges. This seems to be a strong argument for including this new species under the genus Diplacanthopoma.

The length of the head is $3\frac{1}{2}$ in the total without the caudal fin.

The greatest height is one-sixth the length without the caudal fin.

The length of the eyes is a little less than the length of the snout.

There are 19 rays in the pectoral fins.

The filaments composing the ventral fins are composed of two rays.

The male has a well-developed penis.

Two specimens, a male and a female, both about five inches long.

Habitat—Off the S.-E. coast of Arabia ; 540 fathoms.

CRUSTACEA.

Squilla investigatoris, sp. nov.

Eyes large, consisting of two subequal lobes. The carneal axis is slightly oblique to, and a little longer than, the peduncular axis.

The rostrum s ovate, and is a little longer than its breadth at the base, without a carina, but with raised lateral margins.

There are five carinæ on the carapace ; the median one becomes flattened out and obscured anteriorly, and a little less than a rostrum's length behind the rostrum, it bifurcates. The anterolateral angles of the carapace bear spines, which do not extend as far forward as the level of the rostral base. The postero-lateral angles are smoothly rounded.

The first free thoracic segment bears two lateral spines, a long anterior one, curving downwards and forwards, and a short posterior blunter spine projecting transversely outwards; there are no ventral spines. The second free thoracic segment has a bilobed lateral margin, the anterior lobe being smaller and more pointed than the posterior. The lateral margin of the third thoracic segment is also bilobed, the anterior lobe being much the smaller.

Excepting the first, each of the free thoracic segments bears four carinæ, the submedian ones being somewhat obscure. All the abdominal segments excepting the last bear eight carinæ, the submedian pair are obscure. On the upper surface of the second to the fifth abdominal segments there is a small dorsal tubercle which is duplicated by a transverse groove. The lateral carinæ of the first to the sixth, the sublateral carinæ of the third to the sixth, and the submedian carinæ of the fifth and sixth end in a spine posteriorly.

The length of the telson is slightly greater than its breadth. The margin bears four large spines, a pair of submedian and a pair of sublateral; anterior to each sublateral are two lesser marginal spines, the posterior of these bears a small tubercle at its hinder angle. Between the submedian spines there are 8 to 10 teeth. Between the submedian and sublateral spines on each side there are 9 to 10 teeth. The telson bears a mid-dorsal ridge and a ventral tuberculated keel, the dorsal ridge ends posteriorly in a spine, beneath which there are, in some specimens, two or three other spines. At the anterior end of the dorsal ridge is another blunt spine. The basal prolongation of the uropod is finely serrated on its inner margin, the inner division is by far the larger and bears a sharp spine in the middle of its outer edge. The proximal joint of the exopodite is a little longer than the distal and bears seven moveable spines on its outer border.

(Up to this point in the description this species differs only on minor points from *S. nepa*, *S. stridulans* and several other species.)

In the raptatorial claw we find the most distinctive feature. The dactylus bears about fifteen long, delicate curved teeth, the number varying within wide limits. The number of teeth in sixteen counted specimens was as follows:—13, 17, 16, 16, 14, 18, 14, 14, 13, 10, 16, 13, 17, 15, 17, 16.

This variation has no relation to sex. Not only does the number vary, but the length of the teeth and the amount of their curvature is very variable.

The opposing border of the propodite is finely serrated and bears three moveable denticles near its base; of these the middle one is much the smallest. The carpus bears three stout blunt spines. The posterior angle of the claw, when folded up, does not reach as far as the posterior angle of the carapace.

Numerous specimens; sexes about equally distributed.

Colour—Very variable, thorax and abdomen sand-colour with minute black spots; telson and uropodites show a blue-black colouration irregular in its distribution.

Habitat—S.-E. coast of Arabia, 110 fathoms.

Munidopsis spinihirsuta, sp. nov.

The length of the carapace is very slightly greater than the breadth.

The rostrum, which is less than half the length of the carapace, curves upwards especially towards the tip, is carinate and bears an obscurely serrated lateral margin. The entire upper surface and lateral margins of the carapace are covered with large pointed spines which curve forwards; these spines are arranged with some approach to symmetry; they are most numerous over the gastric regions; they all bear long hairs.

There are six spines on the posterior border of the carapace. The upper surfaces of the first three abdominal segments bear hairy spines.

The eyes are colourless, egg-shaped, and one-third the length of the rostrum; they are surmounted by a flat, curved, hirsute spine.

There is a small spine on the anterior border of the carapace between the eye and the second antenna forming the boundary of an orbit.

The chelipeds are nearly equal and are about as long as the entire body in the male (female unknown). The merus and carpus are covered with spines; there is a row of small spinules on the inner border of the propodite; the fingers are shorter than the palm. From the second to the fourth thoracic leg, the mero-, carpo-, and propodite are covered with small spines on their upper surfaces; the dactylus in these appendages is half the length of the propodite. There are no epipodites on the chelipeds or any of the walking legs. The basal joint of the peduncle of the second antenna has an external and an internal spine of equa size. The flagellum is about the same length as the body.

Three small males; largest $1\frac{1}{8}$ inch from telson to rostrum.

Colour—Pinkish yellow.

Habitat—Off S.-E. coast of Arabia; 492 fathoms.

RECORDS OF HEMIPTERA AND HYMENOPTERA FROM THE HIMALAYAS.

By C. A. PAIVA, *Entomological Assistant, Indian Museum.*

A considerable number of Hymenoptera and Hemiptera were added to the Indian Museum collection during the year 1906, and a very large proportion of these were collected in localities situated on the Himalayas and at their base. I propose to give a list of those species which I have been able to identify, restricting myself to Himalayan and sub-Himalayan specimens. This will not be a complete, or anywhere near complete, list of all the species which have up to the present been recorded from these tracts, but merely some of those which were collected during the years 1905 and 1906 by four or five collectors.

I have not attempted to deal with the Non-aculeate forms, the Ants and the Chrysididæ among the Hymenoptera; nor with the Jassids and other inconspicuous families among the Homoptera, nor the aquatic families of the Heteroptera.

The importance of such a list is that the localities are quite definite and that at least the approximate altitude of each place is given. The date of capture is also of interest.

The principal localities from which the collections have been received are :—

Mussoorie, 7,000 feet, May to August 1905.
Naini Tal, Kumaon, 6,400 feet, October 1906.
Bhim Tal, Kumaon, 4,500 feet, September 1906.
Chandragiri, Nepal, *circa* 8,000 feet, October 1906.
Nagarkote, Nepal, *circa* 6,000 feet, October 1906.
Thankote, Nepal, *circa* 5,000 feet, October 1906.
Pharping, Nepal, *circa* 5,000 feet, October 1906.
Katmandu, Nepal Valley, 4,500 feet, October 1906.
Soondrijal, Nepal Valley, October 1906.
Chitlong, Little Nepal Valley, October 1906.
Ghoom, 7,200 feet (Darjiling district), December 1906.
Darjiling, 7,000 feet, October 1905.
Sureil, 5,000 feet (Darjiling district), April 1905.
Pussumbing, 4,700 feet (Darjiling district), December 1906.
Tukvar, 4,500 feet (Darjiling district), October 1906.
Barnesbeg, 3,000 feet (Darjiling district), October 1906.
Kurseong, 5,000 feet (Darjiling district), May 1906.

<table>
<tr><td>Tindharia, 2,800 feet</td><td rowspan="4">All on the railway between Siliguri and Darjiling.</td><td rowspan="4">June 1906</td></tr>
<tr><td>Rungtong, 1,400 feet</td></tr>
<tr><td>Sookna, 540 feet</td></tr>
<tr><td>Gyabari, 350 feet</td></tr>
</table>

Siliguri, at the foot of the Eastern Himalayas, June 1906.
Tonglu, 9,000 feet, September 1906.
Phallut, 11,000 feet, ,, ,,
Kalipokri, 10,000 feet, ,, ,,
Sandakphu, 10,500 feet, October 1906.
} All on the border between British Sikhim and Nepal.

The nomenclature adopted is that of Col. C. T. Bingham, as regards the Hymenoptera, and Mr. W. L. Distant, as regards the Hemiptera, in the "Fauna of British India and Ceylon." Specimens of numerous obscure Himalayan species not recorded in this list have been sent to these gentlemen for identification.

HYMENOPTERA.

Fam. Mutillidæ.

Name.	*Locality.*	*Collector.*
Mutilla emergenda, Magr. ..	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
,, decora, Smith ..	Chandragiri, Nepal (Oct. 1906)	R. A. Hodgart.
,, funeraria, Smith ..	Katmandu, Nepal ,,	,,
,, antennata, Smith ..	Soondrijal, Nepal ,,	,,
,, ,, ,, ..	Mussoorie (May to Aug. 1905) ..	E. Brunetti.
,, subanalis, Magr. ..	Nagarkote, Nepal (Oct. 1906) ..	R. A. Hodgart.

Fam. Scoliidæ.

Tiphia incisa, Cam. ..	Darjiling (Oct. 1905) ..	E. Brunetti.
,, implicata, Cam. ..	Nagarkote Nepal (Oct. 1906) ..	R. A. Hodgart.
,, ,, ,, ..	Darjiling (Oct. 1905) ..	E. Brunetti.
,, compressa, Smith ..	,, ,, ..	,,
,, ,, ,, ..	Gowchar, Nepal (Oct. 1906) ..	R. A. Hodgart.
,, aureipennis, Bingh. ..	Darjiling (Oct. 1905) ..	E. Brunetti.
,, rufo-femorata, Smith ..	,, ,, ..	,,
Myzine dimidiata, Guér. ..	Siliguri (June 1906) ..	J. B. Richardson.
,, madraspatana, Smith ..	,, ,, ..	,,
,, anthracina, Smith ..	Soondrijal, Nepal (Oct. 1906) ..	R. A. Hodgart.
,, fuscipennis, Smith ..	Chitlong, Nepal (Oct. 1906) ..	,,
Scolia quadripustulata, Fabr. ..	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
,, capitata, Guér. ..	,, ,, ,,	,,
,, rubiginosa, Fabr. ..	Chitlong, Nepal (Oct. 1906) ..	R. A. Hodgart.
,, aureipennis, Lepel. ..	Bhim Tal (Sept. 1906) ..	N. Annandale.
,, cyanipennis, Fabr. ..	Katmandu, Nepal (Oct. 1906) ..	R. A. Hodgart.
Elis thoracica (Fabr.) ..	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
,, annulata (Fabr.) ..	,, ,, ,, ..	,,
,, hirsuta, Sauss. ..	,, ,, ,, ..	,,
,, fimbriata (Burm.) ..	,, ,, ,, ..	,,
,, asiatica, Sauss. ..	Katmandu, Nepal (Oct. 1906) ..	R. A. Hodgart.
,, prismatica (Smith) ..	Darjiling (Oct. 1905) ..	E. Brunetti.

Fam. Pompilidæ.

Salius flavus (Fabr.) ..	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
,, sycophanta (Gribodo) ..	Katmandu, Nepal (Oct. 1906)	R. A. Hodgart.
,, fenestratus (Smith) ..	Nagarkote ,, ,, ..	,,

Name.	*Locality.*	*Collector.*
Pompilus pedestris, Smith ..	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
,, analis, Fabr. ..	,, ,, ,, ..	,,
,, maculipes, Smith ..	,, ,, ,, ..	,,
,, reflexus, Smith ..	,, ,, ,, ..	,,
,, ,, ,, ..	Chitlong, Nepal (Oct. 1906) ..	R. A. Hodgart.

FAM. SPHEGIDÆ.

Larra maura (Fabr.) ..	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
Notogonia subtessellata (Smith)	,, ,, ,, ..	,,
,, tristis (Smith) ..	,, ,, ,, ..	,,
Liris aurata (Fabr.) ..	,, ,, , ..	,,
Trypoxylon intrudens, Smith ..	Mussoorie (May to Aug. 1905)	E. Brunetti.
Ammophila atripes, Smith ..	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
,, ,, ,, ..	Soondrijal, Nepal (Oct. 1906) ..	R. A. Hodgart.
,, punctata (Smith)..	,, ,, ,, ..	,,
,, ,, ,, ..	Nagarkote ,, ,, ..	,,
,, ,, ,, ..	Chitlong ,, ,, ..	,,
,, ,, ,, ..	Bhim Tal (Sept. 1906) ..	N. Annandale.
,, ,, ,, ..	Mussoorie (May to Aug. 1905)	E. Brunetti.
Sceliphron violaceum (Fabr.) ..	Siliguri (June 1906) ..	J. B. Richardson.
,, ,, ,, ..	Tindharia ,, ..	,,
,, ,, ,, ..	Nagarkote, Nepal (Oct. 1906) ..	R. A. Hodgart.
,, madraspatanum (Fabr.)	Katmandu, Nepal (Oct. 1906)	,,
,, ,, ,, ..	Siliguri (June 1906) ..	J. B. Richardson.
,, formosum (Smith)	Mussoorie (May to Aug. 1905)	E. Brunetti.
Sphex luteipennis, Mocs. ..	Katmandu, Nepal (Oct. 1906)	R. A. Hodgart.
,, nigripes, Smith ..	Soondrijal, ,, ,, ..	,,
Psen orientalis, Cam. ..	Mussoorie (May to Aug. 1905)	E. Brunetti.
,, ,, ,, ..	N. of Tonglu, 9,000′ (Oct. 1906)	I. H. Burkill.
Pemphredon fuscipennis, Cam.	Mussoorie (May to Aug. 1905)..	E. Brunetti.
Stizus vespiformis (Fabr.) ..	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
,, prismaticus (Smith) ..	,, ,, ,, ..	,,
Cerceris instabilis, Smith ..	Soondrijal, Nepal (Oct. 1906) ..	R. A. Hodgart.
Oxybelus canescens, Cam. ..	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
Crabro buddha, Cam. ..	,, ,, ,, ..	,,

FAM. EUMENIDÆ.

Eumenes conica, Fabr. ..	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
,, esuriens, Fabr. ..	,, ,, ,, ..	,,
,, petiolata, Fabr. ..	,, ,, ,, ..	,,
,, affinissima, Sauss. ..	Mussoorie (May to Aug. 1905)	E. Brunetti.
Rhynchium brunneum (Fabr.)	,, ,, ,,	,,
,, ,, ..	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
,, hæmorrhoidale (Fabr.) ..	Tindharia ,, ,, ..	,,
,, argentatum (Fabr.)	Siliguri, N. Bengal ,, ..	,,
,, ,, ,, ..	Katmandu, Nepal (Oct. 1906)	R. A. Hodgart.
,, flavomarginatum, Smith ..	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
,, metallicum, Sauss.	,, ,, ,,	,,
Odynerus ceylonicus, Sauss. ..	,, ,, ,,	,,
,, punctum (Fabr.) ..	,, ,, ,,	,,
,, sichelii, Sauss. ..	,, ,, ,,	,,
,, sikhimensis, Bingh.	Soondrijal, Nepal (Oct. 1906)	R. A. Hodgart.

FAM. VESPIDÆ.

Name.	*Locality.*	*Collector.*
Polybia orientalis, Sauss. ..	Tindharia (June 1906) ..	J. B. Richardson.
,, ,, ,, ..	Bhim Tal (Sept. 1906) ..	N. Annandale.
,, ,, ,, ..	Chitlong, Nepal (Oct. 1906) ..	R. A. Hodgart.
,, ,, ,, ..	Soondrijal ,, ,, ..	,,
Icaria ferruginea (Fabr.) ..	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
,, marginata (Lepel.) ..	Tindharia (June 1906) ..	,,
,, variegata (Smith) ..	Siliguri, N. Bengal (June 1906)	,,
Polistes schach (Fabr.) ..	Bhim Tal (Sept. 1906) ..	N. Annandale
,, ,, ,, ..	Katmandu, Nepal (Oct. 1906)	R. A. Hodgart.
,, sagittarius, Sauss. ..	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
,, stigma (Fabr.) ..	,, ,, ,, ..	,,
,, maculipennis, Sauss.. .	Katmandu, Nepal (Oct. 1906)	R. A. Hodgart.
,, ,, ,, ..	Soondrijal ,, ,, ..	,,
,, ,, ,, ..	Mussoorie (May to Aug. 1905)	E. Brunetti.
,, adustus, Bingh. ..	Kurseong (May 1906) ..	N. Annandale.
,, ,, ,, ..	Soondrijal, Nepal (Oct. 1906) ..	R. A. Hodgart.
,, hebræus (Fabr.) ..	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
Vespa magnifica, Smith ..	Bhim Tal (Sept. 1906) ..	N. Annandale.
,, ,, ,, ..	Nagarkote, Nepal (Oct. 1906)	R. A. Hodgart.
,, cincta, Fabr. ..	Katmandu, Nepal ,, ..	,,
,, ,, ,, ..	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
,, basalis, Smith ..	Soondrijal, Nepal (Oct. 1906) ..	R. A. Hodgart.
,, flaviceps, Smith ..	,, ,, ,,	,,
,, ,, ,, ..	Mussoorie (May to Aug. 1905)..	E. Brunetti.
,, auraria, Smith ..	,, ,, ..	,,
,, ,, ,, ..	Chitlong, Nepal (Oct. 1906) ..	R. A. Hodgart.
,, ,, ,, ..	Soondrijal, Nepal ,, ..	,,

FAM. APIDÆ.

Halictus lucidiusculus, Vachal	Bhim Tal (Sept. 1906) ..	N. Annandale.
Andrena mephistophelica, Cam.	,, ,, ..	,,
Nomia curvipes, Fabr. ..	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
,, thoracica, Smith ..	Soondrijal, Nepal (Oct. 1906)	R. A. Hodgart.
,, aurifrons, Smith ..	Katmandu ,, ,, ..	,,
,, ,, ,, ..	Nagarkote ,, ,, ..	,,
,, terminata, Smith ..	Sureil (April 1905) ..	A. Alcock.
Steganomus nodicornis, Smith	Mussoorie (May to Aug. 1903)	E. Brunetti.
Megachile conjuncta, Smith ..	Katmandu, Nepal (Oct. 1906)	R. A. Hodgart.
,, disjuncta (Fabr.) ..	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
,, monticola, Smith ..	Gowchar, Nepal (Oct. 1906) ..	R. A. Hodgart.
Ceratina sexmaculata, Smith ..	Mussoorie (May to Aug. 1905)..	E. Brunetti.
Crocisa emarginata, Lepel. ..	Soondrijal, Nepal (Oct. 1906) ..	R. A. Hodgart.
Anthophora cingulata (Fabr.)	Katmandu, Nepal ,, ..	,,
,, ,, ,, ..	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
,, zonata (Linn.) ..	,, ,, ,, ..	,,
,, ,, ,, ..	Mussoorie (May to Aug. 1905)..	E. Brunetti.
Xylocopa latipes (Drury) ..	Tindharia (June 1906) ..	J. B. Richardson.
,, tenuiscapa, Westw.. .	,, ,, ..	,,
,, acutipennis, Smith ..	Katmandu, Nepal (Oct. 1906)..	R. A. Hodgart.
,, fenestrata (Fabr.) ..	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
,, iridipennis, Lepel. ..	,, ,, ,,	,,
,, æstuans (Linn.) ..	,, ,, ,,	,,

Name.	*Locality.*	*Collector.*
Xylocopa dissimilis, Lepel.	.. Nagarkote, Nepal (Oct. 1906) ..	R. A. Hodgart.
Bombus trifasciatus, Smith	.. Phallut, 11,000′ (Sept. 1906) ..	I. H. Burkill.
,, tunicatus, Smith	.. Mussoorie (May. to Aug. 1905)	E. Brunetti.
,, eximius, Smith	.. Sureil (April 1905) ..	A. Alcock.
,, flavescens, Smith	.. Katmandu, Nepal (Oct. 1906) ..	R. A. Hodgart.
,, ,, ,,	Soondrijal ,, ,, ..	,,
,, funerarius, Smith	.. Kalipokri, 10,000′ (Sept. 1906)	I. H. Burkill.
,, ,, ,,	.. N. side of Tonglu, 8,000—10,000′ (Sept. 1906) ..	,,
,, vallestris, Smith	.. Sandakphu, 10,500′ (Oct. 1906)	,,
,, hæmorrhoidalis, Smith	Bhim Tal (Sept. 1906) ..	N. Annandale.
,, ,,	.. Naini Tal (Oct. 1906) ..	,,
,, ,,	.. Mussoorie (May to Aug. 1905) ..	E. Brunetti.
,, orientalis, Smith	.. Tindharia (June 1906) ..	J. B. Richardson.
,, ,, ,,	.. Chandragiri, Nepal (Oct. 1906)	R. A. Hodgart.
,, ,, ,,	.. Katmandu ,, ,, ..	,,
,, ,, ,,	.. Chitlong ,, ,, ..	,,
,, ,, ,,	.. Soondrijal ,, ,, ..	,,
Apis dorsata, Fabr.	.. Siliguri, N. Bengal (June 1906)	J. B. Richardson.
,, ,, ,,	.. Mussoorie (May to Aug. 1905) ..	E. Brunetti.
,, indica, Fabr.	.. Tindharia (June 1906) ..	J. B. Richardson.
,, ,, ,	.. Chitlong, Nepal (Oct. 1906) ..	R. A. Hodgart.
,, ,, ,,	.. Pharping, Nepal ,, ..	,,
,, ,, ,,	.. Nagarkote, Nepal ,, ..	,,
,, ,, ,,	.. Katmandu, Nepal ,, ..	,,
,, ,, ,,	.. Naini Tal (Oct. 1906) ..	N. Annandale.
,, ,, ,,	.. Bhim Tal (Sept. 1906) ..	,,
,, ,, ,,	.. Mussoorie (May to Aug. 1905) ..	E. Brunetti.

HEMIPTERA.

Fam. Pentatomidæ.

Coptosoma W. var. *a*. Montand.	Tindharia (June 1906) ..	J. B. Richardson.
,, nepalense, Westw.	Pussumbing (Dec. 1906) ..	H. H. Mann.
,, naziræ, Atk. ..	,, ,, ..	,,
Cantao ocellatus (Thunb.)	.. Tukvar (Oct. 1906) ..	,,
Pœcilocoris druræi (Linn.)	.. Katmandu, Nepal (Oct. 1906) ..	R. A. Hodgart.
,, purpurascens (Westw.)	Chitlong, Nepal ,, ..	,,
,, interruptus (Westw.)	.. Soondrijal ,, ,, ..	,,
,, rufigenis Dall.	.. Nagarkote ,, ,, ..	,,
Chrysocoris grandis (Thunb.)	.. Kurseong (May 1906) ..	N. Annandale.
,, fascialis (White)	.. Bhim Tal (Sept. 1906) ..	,,
Lamprocoris roylii (Westw.)	.. Kurseong (May 1906) ..	,,
,, ,, ,,	.. Bhim Tal (Sept. 1906) ..	,,
,, spiniger (Dall.)	.. Kurseong (May 1906) ..	,,
Stibaropus minor, Walk.	.. Siliguri, N. Bengal (June 1906)	J. B. Richardson.
Dalpada affinis, Dall.	.. Bhim Tal (Sept. 1906) ..	N. Annandale.
,, ,, ,,	.. Katmandu (Oct. 1906) ..	R. A. Hodgart.
,, ,, ,,	.. Pussumbing (Dec. 1906) ..	H H. Mann.
,, ,, ,,	.. Mussoorie (May to Aug. 1905) ..	E. Brunetti.
,, versicolor (Herr.-Schaeff.)	Nagarkote, Nepal (Oct. 1906) ..	R. A. Hodgart.
Erthesina fullo (Thunb.)	.. Siliguri, N. Bengal (June 1906)	J. B. Richardson.
Halys dentatus (Fabr.)	.. ,, ,, ,,	,,

Name.	*Locality.*	*Collector.*
Asyla feæ, Dist.	Near Ghoom (Dec. 1906)	H. H. Mann.
Sciocoris indicus, Dall.	Mussoorie (May to Aug. 1905)	E. Brunetti.
Æliomorpha lineaticollis (Westw.)	Sookna (June 1906)	J. B. Richardson.
Palomena viridissima (Poda)	Mussoorie (May to Aug. 1905)	E. Brunetti.
Eusarcocoris guttiger (Thunb.)	Sookna (June 1906)	J. B. Richardson.
Carbula indica (Westw.)	Kurseong (May 1906)	N. Annandale
,, ,, ,,	Mussoorie (May to Aug. 1905)	E. Brunetti.
Hoplistodera virescens, Dall.	Pussumbing (Dec. 1906)	H. H. Mann.
Plautia fimbriata (Fabr.)	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
Agonoscelis nubila (Fabr.)	Rungtong (June 1906)	,,
Tropicoris punctipes, Stål.	Nagarkote, Nepal (Oct. 1906)	R. A. Hodgart
Priassus exemptus (Walk.)	Mussoorie (May to Aug. 1905)	E. Brunetti.
Canthecona furcellata (Wolff)	Bhim Tal (Sept. 1906)	N. Annandale.
,, ,, ,,	Chowbal, Nepal (Oct. 1906)	R. Hodgart.
Zicrona cærulea (Linn.)	Mussoorie (May to Aug. 1905)	E. Brunetti.
Eusthenes eurytus, Dist.	Gyabari (June 1906)	J. B. Richardson.
Aspongopus obscurus (Fabr.)	Sookna (June 1906)	,,
Megymenum severini, Bergr.	Kurseong (May 1906)	N. Annandale.
Urolabida histrionica (Westw.)	Bhim Tal (Sept. 1906)	,,
,, ,, ,,	Mussoorie (May to Aug. 1905)	E. Brunetti.
,, tenera, Westw.	Kurseong (May 1906)	N. Annandale.
,, uniloba, Stål.	,, ,,	,,
Urostylis gracilis, Dall.	,, ,,	,,
,, ,, ,,	Pussumbing (Dec. 1906)	H. H. Mann.
Urochela bimaculata, Dall.	Naini Tal (Oct. 1906)	N. Annandale.
,, ferruginea, Dist.	Katmandu, Nepal (Oct. 1906)	R. A. Hodgart.

FAM. COREIDÆ.

Elasmomia granulipes (Westw.)	Kurseong (May 1906)	N. Annandale.
,, ,, ,,	Rungtong (June 1906)	J. B. Richardson.
Ochrochira albiditarsis (Westw.)	Bhim Tal (Sept. 1906)	N. Annandale.
Homœocerus albiguttulus, Stål.	Soondrijal, Nepal (Oct. 1906)	R. A. Hodgart.
Notobitus meleagris (Fabr.)	Kurseong (May 1906)	N. Annandale.
,, marginalis (Westw.)	Pussumbing (Dec. 1906)	H. H. Mann.
Physomerus grossipes (Fabr.)	Kurseong (May 1906)	N. Annandale.
Acanthocoris scabrator (Fabr.)	Bhim Tal (Sept. 1906)	,,
,, ,, ,,	Katmandu, Nepal (Oct. 1906)	R. A. Hodgart.
Cletus punctulatus (Westw.)	Chitlong, Nepal ,,	,,
,, ,, ,,	Kurseong (Sept. 1906)	N. Annandale.
,, ,, ,,	Mussoorie (May to Aug. 1905)	E. Brunetti.
,, ,, ,,	Pussumbing (Dec. 1906)	H. H. Mann.
Leptocorisa varicornis (Fabr.)	,, ,,	,,
,, acuta (Thunb.)	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
,, ,, ,,	Katmandu, Nepal (Oct. 1906)	R. A. Hodgart.
Riptortus fuscus (Fabr.)	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
Serinetha augur (Fabr.)	Naini Tal (Oct. 1906)	N. Annandale.

FAM. LYGÆIDÆ.

Lygæus militaris (Fabr.)	Bhim Tal (Sept. 1906)	N. Annandale.
Graptostethus servus (Fabr.)	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
,, dixoni, Dist.	Chitlong, Nepal (Oct. 1906)	R. A. Hodgart.

Name.	*Locality.*	*Collector.*
Cænocoris marginatus (Thunb.)	Mussoorie (May to Aug. 1905) ..	E. Brunetti.
Nysius ceylanicus (Motsch.) ..	Kurseong (May 1906) ..	N. Annandale.
Malcus scutellatus, Dist. ..	Bhim Tal (Sept. 1904) ..	,,
Pamera pallicornis (Dall.) ..	Pussumbing (Dec. 1906) ..	H. H. Mann.
Peritrechus æruginosus, Dist. ..	Katmandu (July 1906) ..	J. Manners-Smith.
Dieuches leucoceras (Walk.) ..	Pussumbing (Dec. 1906) ..	H. H. Mann.
,, femoralis, Dohrn. ..	Kurseong (May 1906) ..	N. Annandale.

Fam. Pyrrhocoridæ.

Lohita grandis (Gray) ..	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
Physopelta gutta (Burm.) ..	Katmandu (Oct. 1906) ..	R. A. Hodgart.
,, schlanbuschi (Fabr.)	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
Pyrrhopeplus pictus, Dist. ..	Kurseong (May 1906) ..	N. Annandale.
,, ,, ,, ..	Pussumbing (Dec. 1906) ..	H. H. Mann.
Dysdercus cingulatus (Fabr.) ..	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
,, evanescens, Dist. ..	Bhim Tal (Sept. 1906) ..	N. Annandale.
,, ,, ,, ..	Chitlong, Nepal (Oct. 1906) ..	R. A. Hodgart.

Fam. Reduviidæ.

Pygolampis unicolor, Walk. ..	Kurseong (May 1906) ..	N. Annandale.
Harpactor marginellus (Fabr.)	Siliguri, N. Bengal (June 1906)	J. B. Richardson.
,, ,, ,, ..	Mussoorie (May to Aug. 1906) ..	E. Brunetti.
Sphedanolestes pubinotum, Reut. ..	Kurseong (May 1906) ..	N. Annandale.
,, indicus, Reut.	Sureil (April 1905) ..	A. Alcock.
Epidaus atrispinus, Dist.	Kurseong (May 1906) ..	N. Annandale.

Fam. Capsidæ.

Helopetlis theivora, Waterh. ..	Tukvar (Oct. 1906) ..	H. H. Mann.
Gismunda chelonia, Dist. ..	Kurseong (May 1906) ..	N. Annandale.
Deræocoris patulus (Walk.) ..	,, ,, ..	,,

Fam. Cicadidæ.

Pycna repanda (Linn.) ..	Gowchar, Nepal (Oct. 1906) ..	R. A. Hodgart.
Tosena mearesiana (Westw.) ..	Tindharia (June 1906) ..	J. B. Richardson.
Cryptotympana intermedia (Sign.)	Kumaon, probably Bhim Tal (Sept. 1905) ..	L. L. Fermor.
Cryptotympana acuta (Sign.) ..	Bhim Tal (Sept. 1906) ..	N. Annandale.
Platylomia saturata (Walk.) ..	Naini Tal (Oct. 1906) ..	,,
Mata kama, Dist. ..	Nagarkote, Nepal (Oct. 1906) ..	R. A. Hodgart.
Gæana sulphurea (Hope) ..	Sureil (April 1905) ..	A. Alcock.
,, festiva (Fabr.) ..	,, ,, ..	,,
Scieroptera splendidula (Fabr.)	Rungtong (June 1906) ..	J. B. Richardson.

Fam. Fulgoridæ.

Fulgora spinolæ, West. ..	Kurseong (May 1906) ..	N. Annandale.
,, clavata, Westw. ..	Tukvar (Oct. 1906). ..	H. H. Mann.
Lycorma delicatula (White) ..	Kalimpong, Darjiling (Nov. 06)	,,
Euphria aurantia (Hope) ..	Tukvar (Oct. 1906) ..	,,
Purohita arundinacea, Dist. ..	Barnesbeg ,, ..	,,

The following species do not appear to have been previously recorded from the Himalayas :—

HYMENOPTERA.

Mutilla emergenda, Magr.	recorded only from	Upper Burma.
Mutilla decora, Smith	,, ,,	Penang, Bhamo, Upper Burma, Rangoon Distr., Lower Burma.
,, subanalis, Magr.	,, ,,	Upper Burma.
Myzine madraspatana, Smith	,, ,,	S. India.
Scolia cyanipennis, Fabr.	,, ,,	Ceylon and Java.
Salius sycophanta (Gribodo)	,, ,,	S. India, Ceylon (?), Burma, Tenasserim.
Notogonia tristis (Smith)	,, ,,	Tenasserim to the Malay Region and Borneo.
Polybia orientalis, Sauss.	,, ,,	Pegu Hills, Tenasserim, China.
Halictus lucidiusculus, Vachal	,, ,,	Karen Hills, Burma.
Ceratina sexmaculata, Smith	,, ,,	Hong Kong, Upper Burma, Tenasserim and Eastern Siamese Malay States.

HEMIPTERA.

Asyla feæ, Dist.	recorded only from	Burma ; Kakhyen, Kauri.
Priassus exemptus (Walk.)	,, ,,	Naga Hills, Tenasserim, Mt. Mooleyit.
Notobitus meleagris (Fabr.)	,, ,,	Nilgiri Hills, E. Siamese Malay States, China and several islands in the Malay Archipelago.
Serinetha augur (Fabr.)	,, ,,	Calcutta, Bombay, Madras, Ceylon, Assam, Upper Tenasserim, West Yunnan, the Malay Peninsula and Hainan.
Graptostethus dixoni, Dist.	,, ,,	Bombay ; Khandela.
Cryptotympana acuta, Sign.	,, ,,	Bhutan Duars, Java, Borneo, Lombok, Philippines, Timor.
Lycorma delicatula (White)	,, ,,	Assam, Sibsagar (?) ; China.

FURTHER NOTES ON INDIAN FRESH-WATER ENTOMOSTRACA.

By ROBERT GURNEY.

In a short paper published last year in the *Journal of the Asiatic Society of Bengal*, I gave an account of certain Entomostraca in the collection of the Indian Museum. Dr. Annandale has been good enough to send me further collections of freshwater Entomostraca, and it was my intention to continue to work at the Indian species from material supplied by him. Unfortunately pressure of work and other engagements prevents me from fulfilling my part of the task, so that I think it advisable to communicate now the results so far achieved.

The material with which the following notes are concerned consists of twelve bottles containing collections made in Lower Bengal and Chota Nagpur. As my work may subsequently be incorporated in the extended study on the Bengal tanks which, I understand, Dr. Annandale has in hand, I think it best to give the full list of the contents of each sample, together with those of certain others received before, and already mentioned in my previous paper.

Feb. 5th, 1907.

LIST OF THE COLLECTIONS.

1. CALCUTTA—Museum (*Kyd Street*) tank. Deep at centre, shallow at sides; stiff clay bottom; much vegetation. April 5, 1905.
   Simosa elizabethæ (King) (abundant).

2. CALCUTTA—Museum tank. Jan. 21, 1906.
   Simosa elizabethæ (King) (rare).
   Scapholeberis kingi, Sars (abundant).
   Cyclops leuckarti, Claus (common).
   ,, *prasinus*, Fischer (common).
   ,, *phaleratus*, Koch (one specimen).

3. CALCUTTA—Aquarium in the Museum. Oct. 16, 1904.
   Stenocypris malcolmsoni, Brady

4. The same. April 10, 1905.
   Ceriodaphnia rigaudi, Richard.

5. PORT CANNING, Ganges delta—Edge of a brackish pond, water very dirty; vegetation scanty. Jan. 29, 1906.
   Ceriodaphnia rigaudi, Richard.
   Cyclops leuckarti, Claus.

6. PORT CANNING, Ganges delta—Edge of a small brackish pond. *Naias* and *Lemna* fairly abundant. Jan. 28, 1906.
   - *Ceriodaphnia rigaudi*, Richard (a few; some females with ephippia; no males).
   - *Cyclops leuckarti*, Claus (abundant).
   - Also many Amphipods, a few Ephemerid larvæ and *Corixa*.

7. CALCUTTA—Museum tank. Feb. 8, 1906.
   - *Simosa elizabethæ* (King) (common).
   - *Ceriodaphnia rigaudi*, Richard (abundant).
   - *Scapholeberis kingi*, Sars (abundant; some females with ephippia).
   - *Dunhevedia crassa*, King (one specimen).
   - *Cyclops prasinus*, Fischer (a few).
   - *Diaptomus contortus*, n. sp. (common).
   - *Cyclops leuckarti*, Claus.

8. CALCUTTA—Museum tank. Nearly dried up at edges. Feb. 20, 1906.
   - *Diaphanosoma*, sp.
   - *Simosa elizabethæ* (King) (common).
   - *Ceriodaphnia rigaudi*, Richard.
   - *Scapholeberis kingi*, Sars (abundant; some females with ephippia).
   - *Chydorus globosus*, Baird, var. *sculptus*.
   - *Cyclops leuckarti*, Claus.
   - ,, *prasinus*, Fischer.
   - *Diaptomus contortus*, n. sp.
   - *Atya*, sp.

9. CALCUTTA—Museum tank. March 3, 1906.
   - *Diaphanosoma*, sp.
   - *Simosa elizabethæ* (King).
   - *Ceriodaphnia rigaudi*, Richard (common).
   - *Scapholeberis kingi*, Sars (common).
   - *Cyclops leuckarti*, Claus.
   - *Diaptomus contortus*, n. sp.

10. CALCUTTA—Museum tank. Washings of *Spongilla carteri*.
    - *Macrothrix goeldi*, Richard.
    - *Cyclops fimbriatus*, Fischer.
    - ,, *varicans*, Sars.

11. CALCUTTA—Small artificial tank on the Maidan; vegetation rather scanty. Feb. 23, 1906.
    - *Scapholeberis kingi*, Sars (one specimen).
    - *Cyclops leuckarti*, Claus
    - ,, *serrulatus*, Fischer.

12. CALCUTTA—Tank on the Maidan. Feb. 26, 1906.
    - *Lynceus guttatus* (Sars) (rare).
    - ,, *rectangulus* (Sars) (rare).

Cyclops leuckarti, Claus (common).
,, *varicans*, Sars (rare).
,, *prasinus*, Fischer (a few).
Diaptomus contortus, n. sp. (several young, but only two adults).
Pseudodiaptomus lobipes, n. sp. (common, but all females).
Caridina, sp.

13. CALCUTTA—The Zoological Gardens. A small tank with little vegetation ; shallow.
Simosa elizabethæ (King) (one specimen).
Ilyocryptus longiremis, Sars (?) (one decayed young specimen).
Lynceus rectangulus, Sars (common).
Leydigia acanthocercoides, Fischer (?) (one cast skin).
Cyclops leuckarti, Claus.
,, *prasinus*, Fischer (common).
,, *varicans*, Sars (rare).
,, *serrulatus*, Fischer (rare).
Pseudodiaptomus lobipes, n. sp. (common, but only one male).

14. CHAKRADHARPUR, CHAIBASSA DISTRICT, CHOTA NAGPUR—Swamp without shade ; not many plants. March 3, 1906.
Diaphanosoma sarsi, Richard (one specimen).
Simosa elizabethæ (King) (common).
Macrothrix triserialis, Brady (a few).
,, *tenuicornis*, n. sp. (one specimen).
Camptocercus australis, Sars (one specimen).
Lynceus cambouei, De Guerne and Richard (two specimens).
Alonella excisa (Fischer) (rare).
Chydorus sphæricus (O. F. Müller) (rare).
Cyclops oithonoides, Sars (rare).
,, *leuckarti*, Claus.
,, *varicans*, Sars (rare).
,, *serrulatus*, Fischer (rare).
Diaptomus doriai, Richard.
,, *cinctus*, n. sp.
,, *pulcher*, n. sp.
,, *strigilipes*, n. sp.

15. CHAKRADHARPUR—Pool in small stream, in open among water plants ; pool small, shallow, without shade. March 3, 1906.
Cyclops leuckarti, Claus.
,, *serrulatus*, Fischer.

16. CHAKRADHARPUR—Large, shallow tank without shade ; weeds abundant. March 6, 1906.
Diaphanosoma sarsi, Richard (common).
Simosa elizabethæ (King) (abundant ; some females with ephippia).
Ceriodaphnia rigaudi, Richard.
Macrothrix triserialis, Brady (rare).
,, *tenuicornis*, n. sp.

Leydigia australis, Sars (two specimens).
Alonella excisa (Fischer).
Chydorus sphæricus (O. F. M.).
Cyclops serrulatus, Fischer.
,, *diaphanus*, Fischer
Diaptomus doriai, Richard (common).
,, *contortus*, n. sp. (rare).
,, *cinctus*, n. sp. (rare).
Cyclestheria hislopi (Baird) (one specimen).
Stenocypris malcolmsoni (Brady).

17. CHAKRADHARPUR—The same as preceding. March 5, 1906.
Diaphanosoma sarsi, Richard.
Simosa elizabethæ (King).
Ceriodaphnia rigaudi, Richard.
Chydorus sphæricus (O. F. M.).
Cyclops leuckarti, Claus.
Diaptomus contortus, n. sp.
,, *blanci*, De Guerne and Richard.
,, *similis*, Baird.

LIST OF SPECIES.

PHYLLOPODA.

1. *Cyclestheria hislopi* (Baird).

In my first paper I recorded a single specimen of this interesting species from a tank in Calcutta. Another was found in a collection from Chakradharpur (No. 16).

CLADOCERA.

2. *Diaphanosoma sarsi*, Richard.

Chakradharpur (Nos. 14, 16, 17).

A species widely distributed in the Oriental Region, and also recorded from New Guinea and Brazil.

3. *Diaphanosoma*, sp.

Some specimens taken in the Museum tank (Nos. 8, 9).

This is a species which has certain resemblances to *D. singalensis*, Daday, but which appears to be distinct. I prefer for the present to leave it undetermined.

4. *Ceriodaphnia rigaudi*, Richard.

This species occurs in several collections from Chakradharpur and Calcutta (Nos. 6, 7, 8, 9, 16, 17).

5. *Simosa elizabethæ* (King).

This species appears to be the commonest Daphnid in the localities in which the collections were made, though *Ceriodaphnia* *rigaudi* is a good second. (Occurs in collections Nos. 7, 8, 9, 13, 14, 16, 17.)

6. *Scapholeberis kingi*, Sars.

Abundant in the Museum tank in February and at that time a few of the females bore ephippia. In a collection taken in March the numbers had somewhat decreased. (Nos. 7, 8, 9, 11.)

So far this species had only been found in Sumatra and Siam.

7. *Macrothrix triserialis*, Brady.

A few specimens taken at Chakradharpur (Nos. 14, 16).

The ventral margin of the shell is closely serrated anteriorly, but posteriorly the teeth are arranged, as described by Prof. Brady (1886), in groups of three. These grouped teeth are of a somewhat remarkable nature. They appear to me to be of the nature of small hyaline scales overlapping each other somewhat in the manner of a hood. The sculpture of the shell is not alluded to by Prof. Brady, but in the figures given by Prof. Daday (1898), the shell is shown covered with lines enclosing lozenge-shaped areas. In my specimens the shell is marked with conspicuous ridges which do not intersect at all, though they may bifurcate here and there. The form of the upper lip, with its transverse ridges, is characteristic (fig. 21).

8. *Macrothrix tenuicornis*, n. sp.

Carapace of the female nearly round in outline, the posterior angle very slight or altogether absent (fig. 1). The shell is marked with hexagonal or pentagonal reticulations which are so faint as to be seen only with great difficulty. The dorsal margin of the shell is quite smooth. The ventral margin is slightly serrated anteriorly, but posteriorly is rendered uneven by minute, blunt teeth, rather irregularly disposed, and is fringed with long setæ. The head is erect and rounded, with a conspicuous ridge over the eye (fig. 22). The large upper lip begins anteriorly with a marked ridge and is ridged transversely as is the case in *M. triserialis*. The eye and ocellus are small. The first pair of antennæ are long and nearly straight, not dilated at their extremity ; along the inner edge are three large spines, while at the extremity there are two semi-rings of small spines. The tail is of the usual shape, the part anterior to the anus densely setiferous, the setæ apparently not arranged in any definite plan (fig. 2). The anus is guarded by a pair of peculiar flaps. Posterior to the anus the ventral edge of the tail is armed with a row of very minute teeth.

Length of female, ·8—·95 mm.
Width, ·55— ·65 mm.

Found at Chakradharpur (Nos. 14, 16).

9. *Macrothrix goeldi*, Richard.

A single specimen of a Macrothrix was found in some washings from *Spongilla carteri* taken in the Museum tank, Calcutta.

It agrees in all respects with the description given by Richard except in point of size, my specimen, which has no eggs in its brood-pouch and is perhaps not fully grown, being smaller than the type. The species has only been recorded from Chili (Richard, 1897).

10. *Thyocryptus longiremis*, Sars.

A very decayed young specimen, which I refer doubtfully to this species, occurred in a collection in Calcutta (No. 13).

11. *Camptocercus australis*, Sars.

A single female specimen was contained in one of the collections from Chakradharpur (No. 14).

Distribution.—Sumatra, Australia, South America (Argentine and Patagonia).

12. *Lynceus camboüei* (De Guerne and Richard).

Two specimens only in a collection from Chakradharpur (No. 14).

Distribution.—Madagascar, German East Africa, Palestine, Tonkin, Hawaii, Chili, Patagonia.

13. *Lynceus guttatus* (Sars).

A few specimens from the Calcutta maidan and Zoological Gardens (Nos. 12, 13).

Distribution.—Europe, North and South America, Asia and North Africa.

Not uncommon in Calcutta (Nos. 12, 13).

14. *Leydigia australis*, Sars.

Two specimens of this species were taken at Chakradharpur (No. 16).

Distribution.—Ceylon and Australia (Queensland).

15. *Leydigia acanthocercoides*, Fischer.

With some doubt I refer to this species portions of a moulted skin found in a collection from a tank in the Zoological Gardens at Calcutta (No. 13). The form of the postabdomen is in agreement, but I cannot speak for the rest of the body.

16. *Alonella excisa* (Fischer).

A few specimens only, found at Chakradharpur (Nos. 14, 16).

This species appears to occur in every part of the world except Africa.

17. *Chydorus sphæricus* (O. F. Müller).

A very few specimens of this species were taken at Chakradharpur (Nos. 14, 16, 17).

18. *Chydorus globosus*, Baird.

Two somewhat immature specimens of this species were found in a collection from the Museum tank at Calcutta (No. 8).

19. *Dunhevedia crassa*, King.

A single specimen was found in the Museum tank.

If the identity of this species with *D. setigera* (Birge) is accepted (Stingelin, 1904), then its distribution is practically world-wide.

Copepoda.

20. *Pseudodiaptomus lobipes*, n. sp.

Body slender and more or less cylindrical, the head fused completely with the first thoracic segment (fig. 3). The last segment of the thorax is rounded at the angles and bears on each side a small spine, but no cilia. The abdomen, in the female, consists of four segments; the genital segment is scarcely at all dilated. Dorsally it bears minute spines arranged in three transverse rows, the two anterior rows broken in the middle (figures 23 and 24). Laterally there are two groups of larger spines, about four in each group. The posterior edges of the two succeeding segments bear each a row of teeth. The last segment is much shorter than the preceding ones. The furcal rami are divergent, and about four times as long as wide, with long cilia fringing the inner edge. In the male the abdomen consists of five segments, the second, third and fourth toothed along their posterior edge.

The antennæ are scarcely as long as the thorax and consist of twenty-one joints. In the male the terminal section of the prehensile antenna consists of three joints, the line of division between the second and third not very distinct.

The fifth foot of the female is one-branched and made up of three joints (fig. 4). The second joint, which is the longest, is produced at its distal external angle into a strong spine. On its inner face, towards the end, it bears two hyaline membranes the distal one very large. The last joint is produced distally into a long strong spine, and at the base of it there are three short ones. Of these three one is stouter than the others and is toothed on each side; the other two are toothed along one side only.

In the male the right foot of the fifth pair is one-branched and consists of six joints in all, apparently a two-jointed basal part and a four-jointed exopodite (fig. 6). The second joint of the exopodite is produced into a strong spine. The terminal joint is broad and flattened at the base, but continued as a curved spine (fig. 7). The left foot (fig. 8) consists of a basal portion bearing a long laminal process corresponding to the endopodite, and a distal part of two joints representing the exopodite. The second joint of the exopodite is broad and flattened, with a small hyaline membrane on its outer edge.

Length of female, ·35 mm.
,, ,, male, ·95 mm.

Numerous females of this species were found in two collections made in Calcutta (Nos. 12, 13), but it was only after prolonged search that I was able to find a single male. This is all the more remarkable inasmuch as most of the females bore long, slender spermatophores.

21. *Diaptomus contortus*, n. sp.

The form of the body in both sexes is slender, tapering considerably in front, and with the greatest breadth somewhat behind the middle (fig. 9). In the female the division between the fourth and fifth segments of the thorax is marked by a ring of fine denticles. In the male the ring is incomplete dorsally. The fifth segment is scarcely at all expanded laterally and is armed on either side with two teeth, those on the left being larger than those on the right. The first segment of the abdomen is very short, scarcely longer than the second, and bears a long and very stout spine on the left and a shorter and smaller one on the right. In the male the first segment bears a long, slender spine on the right side. The antennæ of the female reach, when reflexed, considerably beyond the end of the furcal setæ. In the male the antepenultimate joint of the prehensile antenna is produced into a short process, recurved at the end, less than half the length of the succeeding joint The last joint has no process.

In the last pair of legs of the female the basal joint bears a very large, spine-like, cuticular process, which appears to be generally larger on the right leg than on the left (fig. 10). The endopodite reaches nearly to the end of the first joint of the exopodite, and is pointed at the end, with a ring of cilia, but no setæ. The second joint of the exopodite bears a very large lateral tooth, at the base of which the vestigial third joint may be detected in the form of a minute tubercle bearing two setæ, one long and one short.

In the male the right leg of the fifth pair is conspicuous for the number and arrangement of the hyaline membranes borne by it. The basal joint bears one pointed process ; the second basal joint bears a large rounded hyaline membrane on its inner face, while the first joint of the exopodite bears two hyaline membranes, one of which has a peculiar semi-lunar outline. The endopodite is slender and cylindrical, longer than the first joint of the exopodite. The second joint of the exopodite bears a large lateral spine rather proximal of the middle. The apical claw is long and much curved, being swollen at the base and peculiarly twisted. In the left leg the terminal joint of the exopodite has a peculiar chela-like shape, owing to the long spine borne by it opposing itself to the very much produced joint itself.

Length of female, 1·25 mm.
,, ,, male, 1·0 mm.

This species occurs in considerable numbers in several collections both from Calcutta and Chakradharpur (Nos. 7, 8, 9, 16, 17).

22. *Diaptomus cinctus*, n. sp.

Form of the body slender, of almost equal width throughout, the head marked off from the thorax by a constriction (fig. 11). The line of division between the last two thoracic segments is marked by a ring of minute teeth. In some specimens the ring appears to be incomplete, no denticles being visible on the dorsal surface. In the female the last thoracic segment is asymmetrical; on the right it is simply rounded and bears a single small spine, while on the left it is produced into a peculiar rounded lappet bearing two short spines. In the male this segment is also slightly asymmetrical, being somewhat produced on the right, bearing a spine on this side, but being simply rounded on the left. The abdomen of the female consists of three segments, of which the first is as long as the other two and the furca together. This segment is not much dilated and bears a spine on each side, that on the left being a little posterior to and larger than that on the right. In the male the first abdominal segment bears a long, slender spine on the right side.

The antennæ reach, when reflexed, considerably beyond the furcal setæ. The prehensile antenna of the male is scarcely at all dilated; the antepenultimate joint has a narrow hyaline lamella, and is prolonged into a curved process about two-thirds as long as the succeeding segment and minutely bifid at the tip.

The fifth leg of the female has the endopodite about three quarters the length of the first joint of the exopodite, one-jointed and slender fig. 12). The third joint of the exopodite is absent, its place being taken by two short spines with a seta between them. The second joint seems to be variable in length, in some specimens, and in one case in one leg of the two, it is shorter and stouter than in the one regarded as typical. In the male the basal joint of each leg bears a hyaline lamella on its inner face. The endopodite of the right leg is short and conical, longer than the first joint of the exopodite The endopodite of the left leg is rather long and slender and the exopodite is finger-shaped, with a long inner seta. The second joint of the exopodite of the right leg bears a short lateral spine very near its base. The terminal spine is relatively short and blunt at the tip.

Length of female, 1·15 mm.
,, ,, male, 1·0 mm.

A few females and two males occurred in a swamp at Chakradharpur and one or two specimens in a tank at the same place (Nos. 14, 16).

23. *Diaptomus blanci*, De Guerne and Richard.

Several specimens taken at Chakradharpur (No. 17).

24. *Diaptomus pulcher*, n. sp.

Body rather stout, the greatest width about the middle, tapering anteriorly (fig. 13). The last thoracic segment of the female but little expanded, and slightly asymmetrical in both sexes. In the female the left side is produced rather more than the right, the reverse being the case in the male. In the male each wing of this segment ends in a sharp point. The abdomen of the female consists of three segments, the first being longer than the last two and the furca combined. It is of nearly equal width throughout and bears, on either side, a short delicate spine. In the male the abdomen consists of five segments. The first bears a rather long, slender spine on the right side, while the fourth is slightly asymmetrical, being produced somewhat backwards to overlap the succeeding segment on the right, in this respect resembling *D. doriai*, Richard. The furcal rami are not divergent and are ciliated in the female on both sides.

The antennæ extend, when reflexed, somewhat beyond the furcal setæ. In the male the prehensile antenna is not much expanded (fig. 14). The antepenultimate joint has a narrow hyaline lamella and a series of teeth (fig. 15). Of these teeth one is large and directed forward and outward beyond the end of the joint. Behind this tooth there are three or four smaller ones springing from the edge of the joint. In one specimen the two posterior teeth appeared to form part of the hyaline lamella, and not to spring from the joint itself.

In the fifth foot of the female (fig. 16) the basal joint has a large spine on its external face; the endopodite is little more than half as long as the first joint of the exopodite, and its end is fringed with hairs. The third joint of the exopodite is quite distinct and bears two setæ.

The right leg of the fifth pair in the male (fig. 17) has a small hyaline lamella on the second basal joint, and the endopodite is barely as long as the first joint of the exopodite. The second joint of the latter is narrow and curved, bearing a large lateral spine very near its base. The left leg has two small hyaline lamellæ on the second basal joint; the endopodite is relatively long, about two-thirds as long as the exopodite.

Length of female, 1·9—1·95 mm.
,, ,, male, 1·75 mm.

Occurrence.—Swamp at Chakradharpur (No. 14).

25. *Diaptomus doriai*, Richard.

Fairly common at Chakradharpur (Nos. 14, 16).

A species so far only known from the Oriental Region, but widely distributed within that Region.

26. *Diaptomus similis*, Baird.

A few specimens found at Chakradharpur (No. 17).

Distribution.—Palestine and Turkestan.

27. *Diaptomus strigilipes*, n. sp.

Body stout and cylindrical, the last two segments of the thorax completely fused (fig. 18). In the female the last segment of the thorax is expanded into rather large wings, each with two very small, blunt teeth. In the male this segment bears a slender sensory spine on either side. The abdomen of the female consists of three segments, of which the first, or genital, segment is longer than the rest of the abdomen. It is somewhat asymmetrical, bearing a short sensory spine on the left, but being produced on the right (fig. 18*a*) into a finger-shaped process bearing a minute sensory tooth at the apex and one on the dorsal face.

The antennæ are very much longer than the whole body. The prehensile antenna of the male is not much expanded; the antepenultimate joint has no hyaline lamella and is produced into a long, slightly curved process.

In the fifth leg of the female (fig. 19) the basal joint bears a very large tooth on its external face: the endopodite is nearly the same length as the first joint of the exopodite, pointed and ciliated at its extremity. The second joint of the exopodite, or claw, has a conspicuous jagged edge, with a variable number of teeth, and may have, in addition, two little teeth on its external face. The third joint is distinct and bears two slender spines.

In the male the second basal joint of the fifth pair of legs bears a small hyaline lamella (fig. 20). The endopodite of the right leg is very much longer than the first joint of the exopodite and is constricted at the end. The second joint of the exopodite is curved and tapering, with a very large lateral spine. The terminal joint is long and sickle-shaped. In the left leg the endopodite is long and slender and the exopodite terminates in a rounded knob bearing an inner short process.

Length of female, 1·3—1·4 mm.
,, ,, male, 1·25—1·3 mm.

Found at Chakradharpur (No. 14).

28. *Cyclops oithonoides*, Sars.

A few specimens taken at Chakradharpur (No. 14).

Distribution.—Europe, Asia Minor, Central Asia, Malay Archipelago, New Guinea, Egypt, North America.

29. *Cyclops leuckarti*, Claus.

By far the commonest Cyclops in these districts.
Collections Nos. 6, 7, 8, 9, 11, 12, 13, 14, 17.

30. *Cyclops serrulatus*, Fischer.

This species appears in several collections (Nos. 11, 13, 14, 15, 16) but does not seem to be abundant. It is a species of worldwide distribution.

31. *Cyclops fimbriatus*, Fischer

Only found in the Museum tank (No. 10). It seems to occur in every part of the world.

32. *Cyclops prasinus*, Fischer.

Common both in Calcutta and Chakradharpur (Nos. 10, 12, 13, 14).

33. *Cyclops diaphanus*, Fischer.

A few specimens found at Chakradharpur (No. 16).

Distribution.—Europe, Palestine and Central Asia.

34. *Cyclops varicans*, Sars.

Calcutta and Chakradharpur (Nos. 10, 13, 14, 16).

Distribution.—Europe, Palestine, North and South America, Patagonia.

OSTRACODA.

35. *Stenocypris malcolmsoni*, Brady.

Chakradharpur (No. 16).

LIST OF REFERENCES.

Brady, G. S.—" Notes on Entomostraca collected by Mr. Haly in Ceylon," *Journ. Linn. Soc. Zool.*, xix, 1886, p. 293.

Daday, E.—" Mikroskopische Süsswaser-Thier aus Ceylon," *Termes Füzetek.* Auhangrheft Zum, xxi, Bd. 1898.

Daday, E.—" Unteruchungen über die Copepoden-fauna von Hinterindien, Sumatra and Java," *Zool. Jahrb. Syst.*, xxiv, heft 3, 1906.

Gurney R.—" On some freshwater Entomostraca in the collection of the Indian Museum, Calcutta," *Journ. and Proc. Asiat. Soc. Bengal*, N. S. ii, No. 7, 1906.

Richard, T.—" Entomostracès de l'Amérique du Sud, recueillis par Mm. Deiters, von Thering, G. W. Müller et C. O. Poppe," *Mem. Soc. Zool. de France*, x, 1897, pp. 263—301.

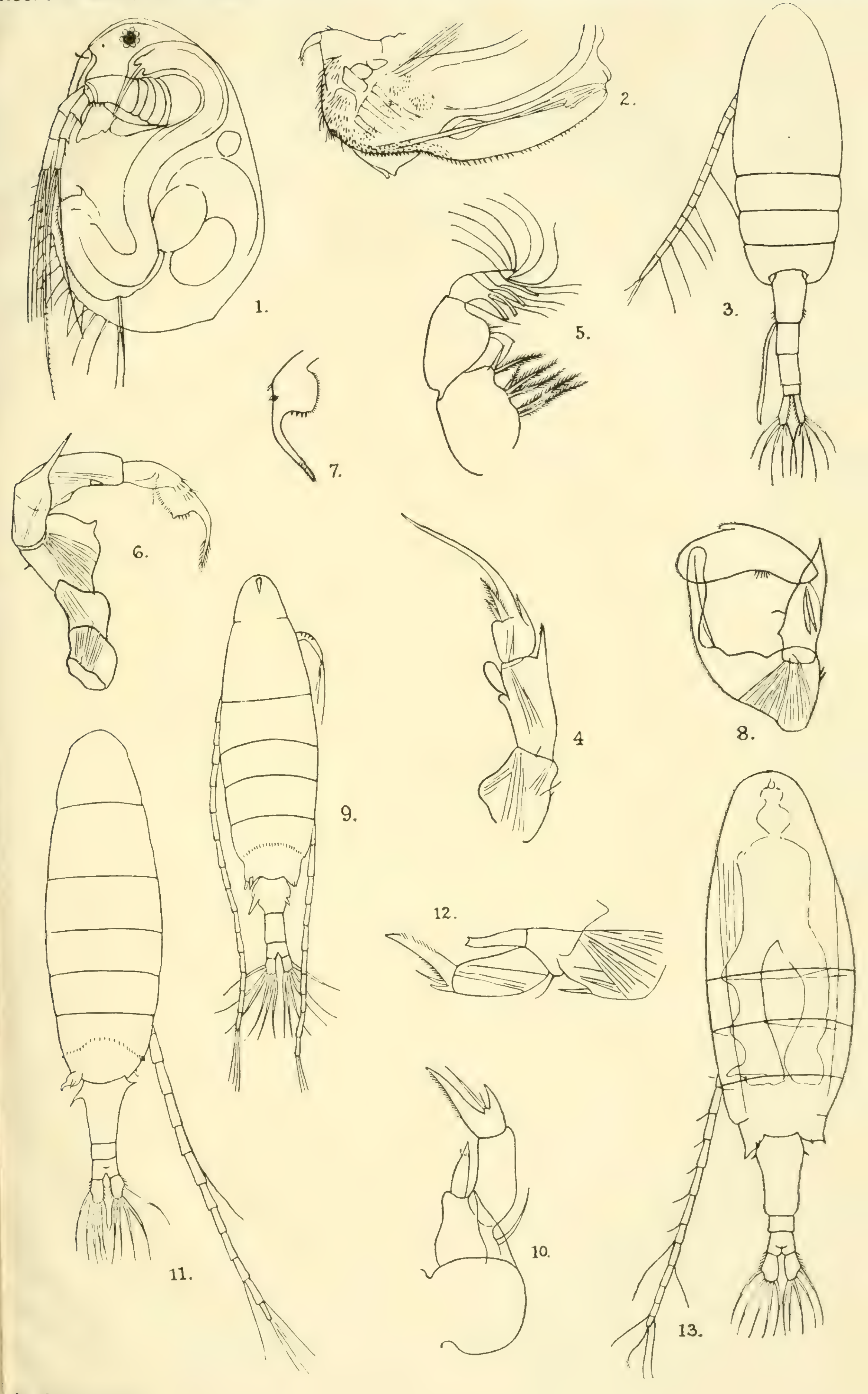
Stingelin, Th.—" Untersuchungen über die Cladoceren—Fauna von Hinterindien, Sumatra and Java," *Zool. Jahrb. Syst.*, xxi, heft 3, 1904.

DESCRIPTION OF PLATES I and II.

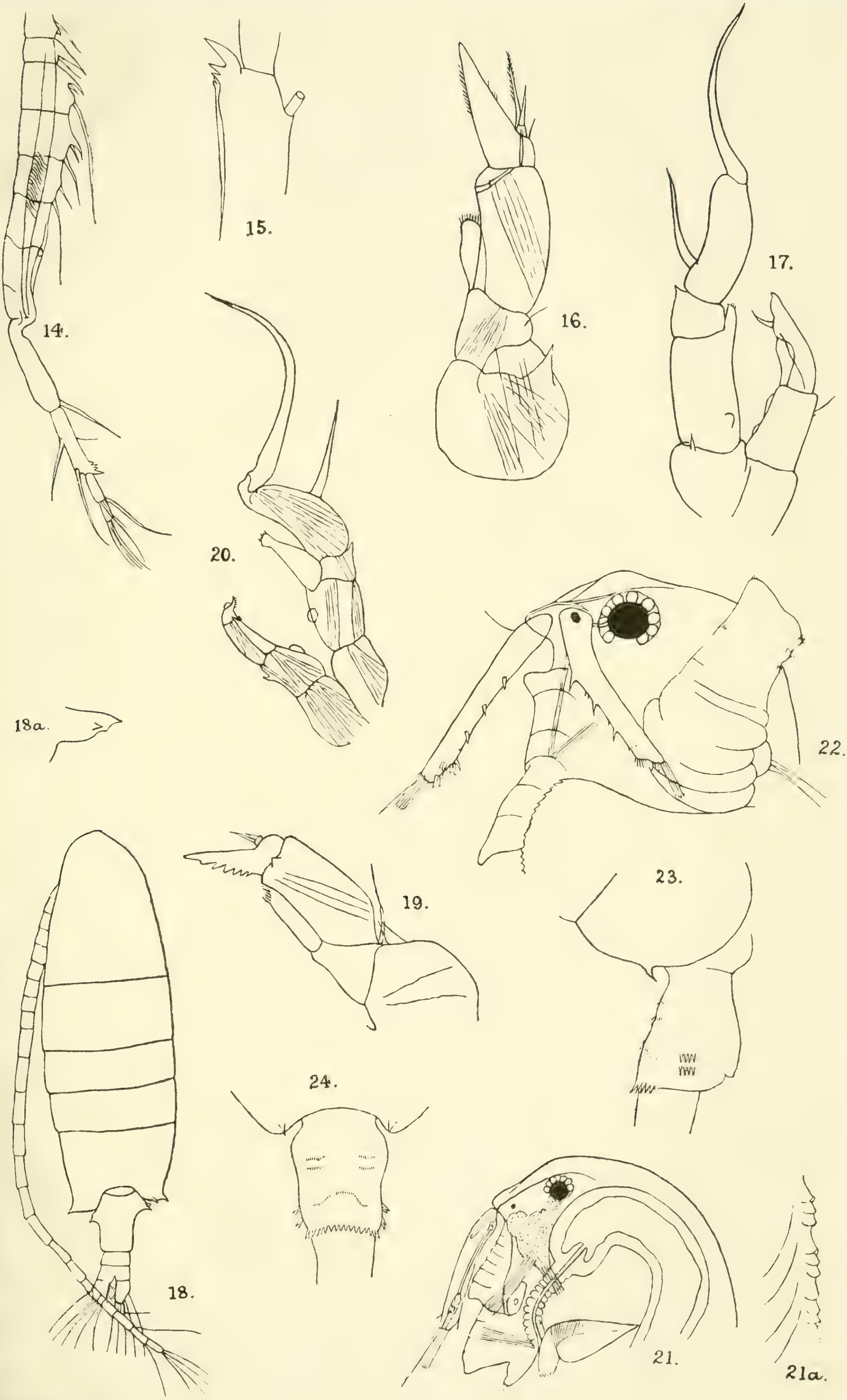
Fig. 1.	*Macrothrix tenuicornis*, n. sp.—		Side view of female.	× 482
Fig. 2.	,,	,,	Postabdomen	× 150
Fig. 3.	*Pseudodiaptomus lobipes*, n. sp.—		Dorsal view of female.	× 51
Fig. 4.	,,	,,	Fifth foot of female.	× 260
Fig. 5.	,,	,,	Maxillipede of female.	× 260
Fig. 6	,,	,,	Right fifth foot of male.	× 260
Fig. 7	,,	,,	Terminal joint of same.	
Fig. 8.	,,	,,	Left fifth foot of male.	× 260

Fig. 9.	*Diaptomus contortus*, n. sp.—		Dorsal view of female.	× 26
Fig. 10	,,	,,	Fifth foot of female.	× 260
Fig. 11.	*Diaptomus cinctus*, n. sp.—		Dorsal view of female.	× 70
Fig. 12.	,,	,,	Fifth foot of female.	× 260
Fig. 13.	*Diaptomus pulcher*, n. sp.—		Dorsal view of female.	× 48
Fig. 14.	,,	,,	Prehensile antenna of male	× 100
Fig. 15.	,,	,,	Terminal joints of the same.	× 440
Fig. 16.	,,	,,	Fifth foot of female.	× 260
Fig. 17.	,,	,,	Fifth feet of male.	× 150
Fig. 18.	,,	*strigilipes*, n. sp.—	Dorsal view of female.	× 64
Fig. 18*a*.	,,	,,	Right-hand process of genital segment.	
Fig. 19.	,,	,,	Fifth leg of female.	× 260
Fig. 20.	,,	,,	Fifth feet of male.	× 150
Fig. 21.	*Macrothix triserialis*, Brady.—		Head.	× 150
Fig. 21*a*.	,,	,, ,,	Margin of shell.	× 260
Fig. 22.	,,	*tenuicornis*, n. sp.—	Head.	× 150

Figs. 23, 24. *Pseudodiaptomus lobipes*, sp. n.—Genital segment highly magnified.



R. Gurney del.



R. Gurney del.

THE FAUNA OF BRACKISH PONDS AT PORT CANNING, LOWER BENGAL.

PART I.—INTRODUCTION AND PRELIMINARY ACCOUNT OF THE FAUNA.

By N. ANNANDALE, *D.Sc., Officiating Superintendent, Indian Museum.*

INTRODUCTION.

The settlement of Port Canning is situated on the Matla river, one of the numerous creeks which run up into the delta of the Ganges, about sixty miles from the open sea. Partly at any rate in connection with the Port Canning Improvement Scheme,[1] which was believed some forty years ago to be about to transform the place into a port rivalling that of Calcutta, a high embankment has been built up along the bank of the estuary, protecting the low-lying land in the neighbourhood from all but exceptional floods. The earth out of which this embankment was formed was apparently dug from a series of pits situated at a short distance, varying up to about a quarter of a mile, from the present edge. These pits are further supplemented by a number of smaller ones immediately behind the embankment, which is repaired with earth dug from the latter when it is injured by an unusually high flood. The original pits vary in size, but all have an area of something approaching half an acre. They are now filled with water and are the ponds dealt with in this paper. Judging from maps in the office of the Port Commissioners, Calcutta, they did not exist in 1855. It is evident from Stoliczka's account,[2] however, that at any rate some of them existed thirty-nine years ago, and he does not say that they had then been dug recently.

The account referred to deals in particular with an Actinian and a Polyzoon taken in the ponds; but it is by no means clear in which pond Stoliczka found his *Sagartia schilleriana*, as there are several ponds "close to the railway station." This point is of importance, because he was only able to find the Actinian in one pond, the position of which he describes in the manner indicated. One factor in the environment of forty years ago, however, has certainly changed; for he gives as one reason why the Actinian was not to be found in the other ponds that the one close to the station alone

[1] See Hunter, *A Statistical Account of Bengal,* vol. i, pp. 91—98 (London, 1875).
[2] In *Journ. Asiat. Soc. Bengal*, part ii, 1869, p. 52.

contained logs of wood to which the animal could attach itself, and now these logs are no longer to be found, either in the pond which is nearest to the railway station or in any other in the neighbourhood; they have evidently been removed by human agency or else have rotted away. The bottom of all the ponds now consists of soft mud, which is devoid of any hard substances except an occasional twig, small tree-stump, or brick, and as there are very few trees in the vicinity, twigs are rare and tree-stumps still more so. The bricks are also scarce, being derived from ruined drains and wells, and there are no stones in this part of Bengal. The ponds are all shallow (probably at no point more than ten feet deep when full) but the depth of the mud at their bottom is considerable. It is black beneath the surface, contains a large amount of organic matter and smells foul when disturbed.

The flora of the ponds consists chiefly of filamentous and unicellular algæ; but in some cases two or three species of Phanerogams occur, notably at least two of *Naias*, a duckweed and a true water-lily, the last being rare, the first abundant in some of the ponds.

An important factor in the environment is the nature of the water. I have described the ponds as brackish, but at some time of the year the water may contain the same proportion of soluble salts as the sea, at others it may even be more strongly saline, and again at others it is much more nearly fresh. As a rule the ponds are completely isolated both from one another and from the estuary. During the cold weather they are exposed to evaporation, which becomes intensified during the hot weather. During the rainy season, on the other hand, they become filled up with fresh water and probably often coalesce. They are also liable to be placed in temporary communication with the estuary occasionally, owing to a flood bursting the embankment; but this does not occur by any means every year. When it does happen, it happens owing to the estuary being swollen with fresh water, which is flowing down from up-country; so that the ponds, even under these conditions, are practically cut off from the sea.

Stoliczka, apparently in 1868 or 1869, had the water of the ponds analysed; but he does not say at what time of year his samples were obtained. He found that the proportion of soluble solids was 12·87 per thousand, sea-water containing from 32 to 39 per thousand. Mr. D. Hooper, Curator of the Industrial Section of the Indian Museum, has kindly examined samples taken by myself in December and March last. Two samples came from a pond in which the Hydrozoon *Irene ceylonensis*, as well as the Actinian, was reproducing its species, and in which the plant *Naias* was abundant. A sample taken from this pond at the beginning of December, a few weeks after the end of the rainy season, was found to contain 12·13 per thousand of soluble salts, while another taken on March 17th contained 20·22 per thousand. At the latter date water from the edge of the Matla at Port Canning contained 25·46 per thousand, and that from a second pond near the first

23·16. This second pond had a fauna almost identical with that of the first except in the absence of the Hydrozoon; but its flora was entirely cryptogamic.

I am indebted to Capt. J. A. Black, I.M.S., Chemical Examiner to the Government of India, for a more detailed analysis of a sample from the second pond taken on January 6th. It is as follows:—

Chloride of Sodium	13·8	parts per thousand.
,, ,, Magnesium	0·6	,, ,, ,,
Sulphate of Magnesium	0·7	,, ,, ,,
,, ,, Calcium	2·1	,, ,, ,,
Nitrates, etc.	0·3	,, ,, ,,
Total ..	17·5	

Stoliczka's analysis was, in detail, as follows:—

"Chloride of Sodium (including Potassium) ..	9·81
,, ,, Calcium	0·46
,, ,, Magnesium	0·93
Sulphate of Magnesium	1·17
Carbonic acid, etc.	0·50";

the soluble substances being also calculated in parts per 1,000.

Stoliczka noted that the water in the ponds was almost fresh during the rains, and in the tank from which my first sample was taken the water-level had sunk only a short distance below the top of the bank, the dry weather having been of no more than a few weeks' duration. All that can be said, therefore, as regards the salinity of the water in the ponds, is that it varies considerably at different times of the year. The range in variation which the members of the fauna are able to survive, is perhaps more remarkable than what may be regarded in different instances either as the deficiency or the excess of salt in the medium in which they live.

THE FAUNA OF THE PONDS.

I do not propose at present to attempt more than a general description of the fauna of these ponds, with notes on some particularly striking species. Specimens of several important groups are now in the hands of specialists in Europe, whose determinations will make a more detailed discussion of greater value after their researches are complete.

Protozoa.—The most conspicuous representatives of the Protozoa found in the ponds are *Carchesium polypinum* and *Folliculina ampulla.* The latter of these is commonly found in salt water but also occurs in fresh, while the *Carchesium* is commonly an inhabitant of fresh water. In the ponds, *F. ampulla* occurs most frequently in close association with the Hydroid stage of *Irene ceylonensis.* Indeed, so frequently is this the case that I was able in almost all instances to detect the presence of the Hydroid, itself almost invisible to the naked eye, by the dark spots due to groups of the Protozoon among the branches of its hydrorhiza. The Protozoon also occurs independently in the ponds, but rarely. *Carchesium polypinum* is just as frequently found attached to colonies of the Polyzoon *Victorella pavida*, but is also common apart from this animal.

Many other representatives of the Protozoa were taken in the ponds; they have been submitted, together with other microscopic organisms, to Prof. von Daday, of Buda-Pesth.

Porifera.—It was in the same ponds that my types of *Spongilla lacustris* var. *bengalensis* (1) were taken in the winter of 1905–6, but in that of 1906–7 this form was entirely replaced by another agreeing closely with Bowerbank's description of his *S. cerebellata* (2). Other specimens, taken near Calcutta and in northern Bengal and sent me from the Chilka Lake in Orissa, convince me that the two forms are identical as regards taxonomic position, being no more than temporary phases of *S. alba*, Carter (3), which in its turn may be no more than an Oriental race of the widely distributed *S. lacustris*. This is a point, however, which I hope to discuss more fully on another occasion. All the sponges in the ponds had perished and most had completely disintegrated by the middle of March.

A notable point as regards these Sponges growing in brackish ponds is the number of animals which take temporary or permanent shelter in their canals. Not only do several species of Amphipods common in the ponds use these canals as temporary resting-places, but an Isopod of distinctly marine facies is common in them and is apparently not found elsewhere in the same habitat. Several small Lamellibranch Molluscs (*Corbula*, spp.), young individuals of the Actinian to be described later, a larval Dragon Fly, and several species of Chironomid larvæ were also found in the canals of the Sponge, while a Cirripede (*B. amphitrite*) was taken buried in the substance of one specimen. In my account of *S. lacustris* var. *bengalensis*, I noticed that those specimens of the Sponge which had any definite colour were dark green owing to the presence in them of a filamentous alga. A similar case of apparent symbiosis has been recorded from Celebes by Professor and Mme. Weber (4); but I am now confident that in such cases the alga should be regarded as a parasite of the Sponge. In keeping certain species of freshwater Sponge, *e.g.*, *S. carteri*, alive in an aquarium in Calcutta, one of the difficulties to be contended with is the rapid growth of just such filamentous algæ, which block up the canals and finally kill the organism. In the Port Canning ponds Sponges infested with the alga are evidently in an unhealthy condition and are usually found towards the end of the season.

Cœlenterates.—Besides the form of *Metridium schillerianum* (Stol.) to be described in a subsequent paper of this series, I have only found one Cœlenterate in the ponds, namely the Hydrozoon *Irene ceylonensis* (5); and that only in one pond. The Medusæ were abundant from the end of November till the beginning of January.

At the beginning of December they were not sexually mature; at Christmas G. C. Chatterjee found specimens in which he could detect ova; at the beginning of January only spent individuals, dead or moribund, could be procured, their umbrellas persisting for some days after the sense-organs and gonads had disappeared. At the last date, however, specimens of the Hydroid were taken in which the gonophores still bore gonosomes half developed. A second brood was sexually mature in March. I have already described the Hydrozoon of this species briefly, and hope to do so more fully in the present series; the Medusa was described by Browne from the seas of Ceylon. Both Medusa and Hydroid show a power of resisting unfavourable conditions (especially lack of aëration of the water) remarkable in their order and contrasting markedly with the feeble nature of this power displayed by *Hydra* in India. A large number of the Medusæ lived for over 48 hours in a small corked tube of water in which a single *Hydra* would hardly have survived for an hour.

In the smaller ponds near the embankment I found two other Hydrozoa, one of which appears to be specifically identical with the European *Bimeria vestita*, which has recently been recorded from South America (6), while the other represents a new species of *Syncoryne*. None of these genera have representatives in fresh water, but all belong to the littoral zone.

Mollusca.—Stoliczka (7) stated that most of the Mollusca in the ponds belonged to marine types; but this is putting the matter a little too strongly, for many of the species belong to characteristic lacustrine genera, while others are common in estuaries. Nevill (8) describes *Hydrobia* (*Belgrandia*) *miliacea* as occurring in " brackish-water ponds (at Port Canning), associated with *Valvata* (?) *microscopica*, Nev., new species of *Blythinia*, *Martesia*, *Teredo* (?), *Pharella*, *Theora*, *Stenothyra blanfordiana*, etc." Preston (9) has recently described five new species of *Corbula* and one of *Bithinella* from my own collection, and I have also found an *Ampullaria* and two species of *Melania*. Although several species of *Onchidium* are not uncommon on the banks of the Matla, while at least one occurs in ditches and pools of brackish water as far inland as Calcutta, I have not found any in the Port Canning ponds.

Nematode.—Dr. von Linstow (10) has described a new Nematode of the genus *Oncholaimus* from the ponds. All previously known species of this genus are marine.

Rotifers and Gastrotricha.—The Rotifers have been submitted to Prof. von Daday. In January, 1906, I took among filamentous algæ from the ponds a representative of the Gastrotricha which agrees very closely with Zelinka's (11) figure and description of *Chætonotus schulizei*, which I have also seen in a similar situation in freshwater tanks in Calcutta and Chota Nagpur.

Annelid.—The only Annelid seen was a small Polychæte which burrows in the mud in great numbers.

Polyzoa.—Stoliczka (7) took the Cheilostome *Membranipora bengalensis* in the Port Canning ponds thirty-eight years ago, but notwithstanding a very diligent search, I have been unable to find it in them now, although it still occurs in the estuary at the same place. The only common form in the ponds at present is a Ctenostome which I take to be specifically identical with the European *Victorella pavida*. The Indian form, however, grows more luxuriantly than the European, and often covers large areas on grass-roots and the like; the zoœcia often arise very close together on the stolon and comparatively seldom produce buds. All the individuals I have seen expanded have had eight tentacles. *Victorella* is essentially a brackish-water form, and even *Membranipora* occurs elsewhere in marshes the water of which contains considerably less salt than that of the sea. Miss L. Thornely has lately identified a species found incrusting a brick in one of the ponds as *Bowerbankia caudata* (Hincks); this species also belongs to a genus common in estuaries.

Crustacea.—Of the higher Crustacea all that I can say at present is that the crabs, which are common among the Sponges in the ponds, belong to the genus *Varuna*, which is generally found in the neighbourhood of estuaries, whence it is liable to be carried out to sea (Alcock, *A Naturalist in Indian Seas*, p. 75). Dr. J. de Man has kindly promised to examine specimens of the Decapods, while the Rev. T. R. R. Stebbing has already reported a new genus of Gammarids (which will be described in a future number of these "Records") among the Amphipods.

Gurney (12) has identified the Daphniid *Ceriodaphnia rigaudi* and Copepod *Cyclops leuckartii*, both freshwater species, among the Entomostraca. To these I can add two species of the marine order Cirripedia. A single specimen of *Balanus* was found deeply buried in the tissues of a *Spongilla* and attached to the grass-root to which the Sponge had also affixed itself, in December, 1906. The specimen was small and distorted, probably owing to the nature of its support, but it could be readily identified with *Balanus amphitrite*, a species common at the mouth of the Ganges and having an extraordinarily wide bathymetric range in the Indian seas, for Gruvel (13) has recently recorded examples of the variety *communis*, with which the Port Canning specimen should perhaps be identified, from a depth of over 1,000 fathoms. In another of the ponds I found a brick to which several specimens of *B. patellaris* were attached. This species is abundant in the Matla, occurring with *B. amphitrite* and *Chthamalus stellatus*.

Insects—G. C. Chatterjee (14) found the larva of the Mosquito *Anopheles rossi* abundant in the ponds at the beginning of December and less so towards the end of the same month. Though somewhat scarce, relatively speaking, they were still to be found at the beginning of January; in March I could only find one individual. At all periods between December and the end of March I took several Dragon Fly [1] larvæ, of which *Ischneura senegalensis*

[1] For observations on Dragon Fly larvæ in brackish water in America see Osburn in the *American Naturalist*, vol. xl, p. 395 (1906).

a common species throughout India, was the most abundant. I also took larvæ of an Ephemerid and of at least two Chironomid flies in December and January; they sheltered themselves indifferently in the canals of Sponges or among the zooecia of Polyzoa. During the winter months, at any rate, adult insects of a large number of species are abundant in the ponds. Among the Hemipterous genera represented the following may be mentioned: (surface forms) *Gerris*, *Hydrometra*, *Microvelia* and *Mesovelia*; (forms which live below the surface) *Laccotrephes*, *Nectocoris* *Anisops*; the only common genus not so well represented in the ponds as in the freshwater tanks of Calcutta being *Plea*, with the possible addition of *Sphærodema*. Both these genera, however, very frequently rest among the hanging roots of *Pistia stratiotes* (the Water Plantain), which does not occur in the ponds at Port Canning. Most of the aquatic Coleoptera collected were minute forms, and no Gyrinidæ were seen; but a few common species of large size (*e.g.*, *Cybister convexus*) were taken. Several small Tettigids (Orthoptera) were observed swimming on the surface of the ponds—a habit shared by a large number of the members of this family; and in March a Lepidopterous larva (apparently a species of *Nymphula*) is common on *Naias*, making a cylindrical case like that of a Caddis-worm.

Fish.—Specimens of the following Fish were taken in the ponds:—

Symbranchus bengalensis (one young specimen).
Amblypharyngodon microlepis.
Macrones gulio.
Barbus chola.
,, *stigma.*
Nuria danrica.
Haplochilus melanostigma.
,, *panchax.*
Gobius acutipennis.
,, *giuris.*
,, *alcockii.*
Apocryptes lanceolatus.
Ophiocephalus punctatus.
Anabas scandens.
Trichogaster fasciatus.

There are also one or two minute Gobies, which, if they are adult, represent new species. Mr. Hodgart, who collected for the Museum at Port Canning, further reports *Periophthalmus kœlreuteri* and *Boleophthalmus viridis* from the ponds; but although these species are common on the shore of the estuary, I have not seen them in any of the ponds. None of these fish can be called essentially marine; but most of them are commonly found in brackish water in the neighbourhood of estuaries. *Barbus chola* is usually found in fresh water, and so is *Haplochilus panchax*, which in the ponds is less abundant than *H. melanostigma*; I have recently taken *Gobius alcockii* in a tank at Rajshahi, 150 miles north of Calcutta. Some of the species (*e.g.*, *O. punctatus*) extend inland even as far as mountain tarns in the Himalayas.

Reptiles and Amphibia.—The only Reptile taken in the ponds was the common Water-snake *Tropidonotus piscator*, and the only Amphibians the equally common *Rana cyanophlyctis* and *R. tigrina*. The Indian Toad, *Bufo melanostictus*, is abundant at the edge of the ponds, in which it possibly breeds; Gardiner (15) has recently recorded this species as inhabiting brackish pools in the Maldives. The range in altitude of these Amphibians, and especially of *R. cyanophlyctis* and *B. melanostictus*, shows that they are very adaptable species.

LITERATURE.

1. Annandale, N. .. "Notes on the Freshwater Fauna of India, No. I" (*Spongilla lacustris* var. *bengalensis*), *Journ. Asiat. Soc. Beng.* (New Ser.), vol. ii, 1906, p. 55.
2. Bowerbank, J S .. "Monograph of the *Spongillidæ*," *Proc. Zool. Soc.*, 1863, p. 440.
. Carter, H. J. .. 'History, etc., of known species of *Spongilla*," *Ann. Mag. Nat. Hist.* (5), vii, p. 77 (1881).
4. Weber, M. M. and A. "Quelques nouveaux cas de Symbiose," *Ergeb. Nied. Ost-Ind.* vol. i, p. 48 (1890).
5. Annandale, N. .. "Notes on the Freshwater Fauna of India, No. XI" (the Hydroid of *Irene ceylonensis*), *Journ. Asiat. Soc. Beng.* (New Ser.), vol. iii, 1907, p. 79.
6. Hartlaub, C. .. "Die Hydroiden der magalhaenischen Region," etc., *Zool. Jahrb*, suppl. vi, p. 534 (1905).
7. Stoliczka, F. .. 'Anatomy of *Sagartia schilleriana* and *Membranipora Bengalensis*," *Journ. Asiat. Soc. Bengal*, part 2, vol. xxxviii, p. 28 (1869).
8. Nevill, G. .. "New species of Brackish-water Mollusks," *Journ. Asiat. Soc. Bengal*, part 2, xlix, p. 159 (1880).
9. Preston, H. B. .. "Diagnoses of new Species of *Corbula*," etc., *Ann. Mag. Nat. Hist.* (7), xix, p. 215 (1907).
10. Linstow, O. von .. "A new Nematode of the genus *Oncholaimus*," *Rec. Ind. Mus.*, i, p. 45 (1907).
11. Zelinka, C. .. "Die Gastrotrichen," *Zeitschr. f. Wiss. Zool.*, xlix, p. 209, 1890.

12. Gurney, R. .. "Some Indian Freshwater Entomostraca," *Journ. Asiat. Soc. Bengal*, 1906, p. 273.

13. Gruvel, A. .. "Cirrhipèdes Operculés," etc., *Mem. Asiat. Soc. Bengal*, ii, p. 1 (1907).

14. Chatterjee, G. C. .. "Anopheles larvæ," *Rec. Ind. Mus.*, i, p. 82 (1907).

15. Gardiner, J. S. .. *The Fauna and Geography of the Maldive and Laccadive Archipelagoes*, vol. ii, suppl. ii, p. 1049.

THE FAUNA OF BRACKISH PONDS AT PORT CANNING, LOWER BENGAL.

PART II.—A NEW NEMATODE OF THE GENUS *Oncholaimus*.

By DR. O. VON LINSTOW, *Göttingen*.

The Nematode here described was found among filamentous algæ in a pool of brackish water at Port Canning, which is situated on the Matla estuary in Lower Bengal.

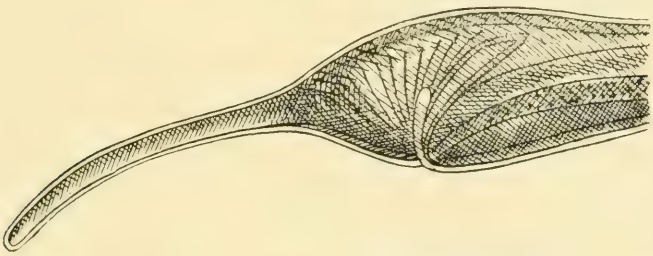


FIG. 1.—Posterior extremity of the male, from the right.

Oncholaimus indicus, sp. nov.

Cuticle smooth, without annular rings. At the anterior extremity there is a large oral cavity measuring 0·036 mm. in length and 0·014 mm. in transverse diameter; in front of this on the ventral surface there is a conical tooth. The caudal end is thickened and narrows abruptly a short distance behind the anus into a caudal appendage, which measures 0·075 mm. in length and 0·0078 mm. in breadth, and is curved inwards slightly towards the belly and rounded posteriorly. This form of tail is identical in the two sexes. Both in the male and in the female the œsophagus measures one-sixth of the total length of the body.

The male is 2·71 mm. long and 0·053 mm. broad, the caudal end occupying 1/25·6 of the length of the whole animal. The spicula are equal, being strongly curved; they measure 0·034 mm. in length. Dorsal to them lies a very short supporting structure.

The female is 2·71 mm. long and 0·057 mm. broad, and in this sex the caudal end measures one twenty-eighth of the total length. The vulva is situated somewhat posterior to the middle of the body and divides the length anterior to it and that posterior in the proportion of 31 to 29. One branch of the uterus stretches forwards, the other backwards. Two eggs are produced, each measuring 0·78 mm. in length and 0·047 mm. in transverse diameter.

The thirty-three known species of *Oncholaimus* live in the sea.

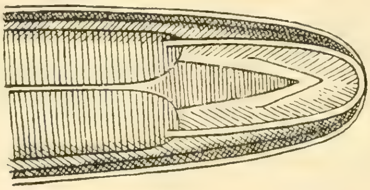


Fig. 2.—Anterior extremity, dorsal view.

[*Oncholaimus indicus* was found in large numbers in the habitat indicated during December, January and March. In the first of these months the water of the pool in which it occurred contained 1·23 per cent. of soluble solids; in January the salinity had increased considerably owing to evaporation; while in March the percentage of soluble solids was 2·022.—N. Annandale.]

THE FAUNA OF BRACKISH PONDS AT PORT CANNING, LOWER BENGAL.

PART III.—AN ISOLATED RACE OF THE ACTINIAN *Metridium schillerianum* (STOLICZKA).

By N. ANNANDALE, *D.Sc., Officiating Superintendent, Indian Museum.*

METRIDIUM SCHILLERIANUM (Stoliczka).

Sagartia schilleriana, Stoliczka, *Journ. Asiat. Soc. Bengal*, part 2, vol. xxxviii, 1869, p 28 ; plates x, xi ; R. Hertwig, *Zool. Rep. H.M.S "Challenger,"* vol. vi, 1882, Actiniaria, p. 71.

Although Stoliczka's description of the typical form of the species is very detailed, the imperfect knowledge of the structure of the Actinians possessed thirty-nine years ago by students of the Cœlenterates, misled him as regards certain important characters, while the fact that he cut no sections prevented him from detecting others. His types are now in a bad state of preservation, the tissues being shrunk and partly decomposed, and have assumed a dark brown colour of which I have been unable to get rid. I have, however, cut sections of two of these specimens, which proved to be so far intact that the arrangement of the mesenteries could be detected. Further, I have made vertical and transverse sections of two fresh examples of this form, and have dissected two others, as well as sectioning four specimens of the new variety, dissecting six, and examining a very much larger number externally. The following description of the species and its variety is based on the material thus used. Although it differs considerably from Stoliczka's written description, it will be found to be in most respects, so far as the typical form is concerned, in accord with his figures, which, for the reasons given above, he appears to have misinterpreted in spite of the accuracy of his observations.

DESCRIPTION OF THE TYPICAL FORM OF THE SPECIES.

Colourless in spirit ; in life translucent, the column being more or less deeply tinged with green and having a variable number of semi-opaque vertical stripes arranged in multiples of six and representing the better developed of the intramesenterial spaces ; parts of the mesenteries often of a deep purple, which may be visible externally; tentacles semi-opaque, often with irregular transverse bars of opaque white. Column cylindrical, as broad or almost as broad as high when normally expanded, broader than high when contracted; in the latter condition mound-shaped, with a considerable oval aperture as a rule remaining open above the tentacles. Tentacles elongated, tapering, perforate at the distal extremity, arranged in five cycles; the innermost cycle with six tentacles, the next with twelve the third with twenty-four, the fourth with forty-eight, the fifth with ninety-six : 186 in all (approximately). Disk ample, oval, not separated from the column when expanded; the mouth large, elongated and narrow; the lips protuberant, with six folds on either side of the mouth; the stomodæum extending more than half way down the column; the gonadial grooves distinct. External surface of the column smooth, generally with rows of suckets arranged vertically; the cinclides, which are difficult to detect in preserved specimens, scattered. Basal disk variable in outline, often extending beyond the periphery of the column, provided with a distinct sphincter, which is visible in living specimens as a thin, semi-opaque ring Circular muscles of the column well developed, confined to the mesoderm; the sphincter elongate in vertical section, consisting of comparatively feeble folds without muscle spaces; radial muscles of the disk and tentacles situated at the base of the ectoderm and not encroaching on the mesoderm. The six primary (complete) pairs of mesenteries fertile; sometimes the first and rarely also the second secondary cycles fertile; the number of secondary cycles from three to five, each consisting of twelve mesenteries; some mesenteries in one or more of the cycles rudimentary, without fully developed retractor muscles and devoid of filaments; acontia very long. Gonads protogynous, the two elements being produced at different times and in different parts of the mesenteries, the ovaries above the testes.

DESCRIPTION OF AN ISOLATED RACE (var. *exul*) OF THE SPECIES.

Column several times as long as broad, vermiform when extended in young specimens sausage or barrel-shaped when contracted. The walls of the column very thin, allowing forty-eight mesenteries to be visible externally as narrow, semi-opaque vertical stripes. Tentacles as in the typical form, except that there are never more than four cycles; the disk in old specimens much reduced, divided into twelve distinct parts. The stomodæum extending less than half way down the column. Basal disk devoid of a sphincter, its periphery merging gradually into the column. The folds of the subtentacular sphincter markedly deeper above than below, with a few oval muscle spaces above. The six pairs of primary mesenteries alone fully developed, the others as a rule lacking retractor muscles and filaments, but the first cycle, or some of its members, sometimes being fertile though feebly muscular. Cinclides in vertical rows on the upper part of the column.

In all other respects, so far as its taxonomic features are concerned, the characters of the variety may be regarded as identical with those of the typical form.

FIG. 1.—Thick transverse section of the column of *M. schillerianum* var. *exul* in the region of the stomodæum, showing the arrangement of the mesenteries, the form of the retractor muscles and the muscular strands of the wall.

COMPARISON BETWEEN THE STRUCTURE OF THE TYPICAL FORM AND THAT OF THE VARIETY.

The above is a general account of the physical characters in which the two forms agree with and differ from one another. In order to explain the manner in which it is probable that these differences have come about, it will be necessary first to compare the structure of the two forms in further detail, and then to give an account of their respective modes of life.

Column.—

The main differences between the typical form and variety are plainly connected with the differences in the form of the column. In the new variety of the species this part of the organism is a thin-walled muscular sac with a bulky lumen; in the typical form the walls are thicker and the cœlenteron very much less spacious. The thinness of the walls in the variety is due to two causes, *viz.*, the nature of the ectodermal layer and the comparatively poor development of the mesoderm. In both forms the ectodermal layer consists of the usual elements, namely, epithelial and glandular cells, sense cells, and nematocysts. The cells do not differ in any feature of importance as regards form or structure from those found in the same layer in other Actinians. Stoliczka has already described and figured the nematocysts (*op. cit.*, plate xi). The secretion of the gland cells mixed with the threads of the nematocysts forms a covering for the column, which, however, is only temporary, and has not the characters of the so-called cuticle found in some Actinians. Unless specimens are very carefully preserved, the whole of the nematocysts of the column and tentacles are forced out of the ectoderm without rupturing, and appear in transverse section to form a separate layer, bound together by slime secreted by the gland cells but external to and distinct from the ectoderm. If living specimens are examined, it will be found that there is no such layer under natural conditions, but that the nematocysts are interspersed with the epithelial and glandular cells. The temporary protective covering is not formed of the nematocysts, but only of their threads and of slime, often with foreign bodies enclosed. In the isolated race the ectoderm consists of a layer of cells parallel to the mesoderm. In the typical form, however, this layer is thrown, all round the periphery of the column, into a series of transverse folds, the function of which I will discuss later. The number of nematocysts and also of gland cells present in this region is perhaps greater in the typical form than in the variety. The suckers, which are as a rule absent in young individuals, consist, in both forms, of relatively deep folds of the ectoderm separated by a space from the mesoderm; they are oval in outline, their main axis being at right angles to that of the column. It is very difficult to detect the cinclides in preserved material, but in life they are easily distinguished as transversely elongated slits with tumid lips. In structure they closely resemble the suckers except that they are perforate; the mesoglœa beneath them is much vacuolated. The vertical rows of suckers, at any rate in the variety, usually correspond to the inter-, those of the cinclides to the intramesenterial spaces; but I have been unable to convince myself that this arrangement is absolutely constant. In the typical form of the species cinclides and suckers occur on all parts of the column, the former being particularly numerous near the two disks; but in the new race both structures are confined to the upper half of the column below the region of the sphincter.

The thickness of the mesoderm is not more than moderate in the typical form; in the variety it is rather less, but the mesoglœa swells out somewhat irregularly in many of the inter- and intramesenterial spaces in such a way that the whole of the layer in such spaces has a roughly spindle-shaped outline in transverse section. In both forms the nerve cells situated towards the external limits of the mesoderm are large and numerous, and in both the mesoglœa itself has a distinctly reticulo-fibrillar structure and contains, especially externally, a number of irregularly placed vertical spaces and channels. In the typical form of the species, the wider folds of the ectoderm rest on slight projections and concavities in the mesoderm, while in both forms broad mesodermal "bays" occur on the endodermal surface.

The endoderm of the column in both forms consists of considerably elongated epithelial cells provided with cilia, which are particularly long and active towards the upper limits of the column. In the typical form, the number of gland cells interspersed in the epithelium is perhaps greater than in the variety. In the former, the cells lining the intermesenterial spaces are markedly longer, and contain more zooxanthellæ, than those lining the intramesenterial spaces. This difference is not so clear in the variety but appears to exist to a slight extent. In both forms the zooxanthellæ do not encroach upon the basal part of the cells.

An important point to be noted is that the differences in structure of the column are much more marked in the case of full-grown individuals of the two forms than they are in that of very young individuals of the variety and adults of the typical form. As can be seen from the figures on plate iv, young individuals of the variety measuring about 10 mm. in length when contracted, are only about four times as long as broad, their proportions being, however somewhat variable. In full-grown specimens of the same form, however, the length is at least ten times the transverse diameter. When strongly contracted the column of the young individuals assumes a barrel-shaped outline which does not differ very greatly from the conical outline of the typical form in same state, and the younger the individual is, so far as my experience goes, the less is the length in excess of the transverse diameter. It is only well-grown individuals, of over 4 cm. in length when they are contracted, which can be called wormlike, and as will be shown later, contraction takes a different course in full-grown examples of the variety than that which occurs in young examples of the variety or full-grown individuals of the original form. In the typical form and in the young of the variety, the column is able to stand vertically upright, but in larger individuals of the variety this is impossible without artificial support.

Muscles.—

The circular muscular layer of the mesoderm of the column lies within the nervous layer of the same structure and, in the variety, occupies the greater part of the mesoglœa. In the typical form it is relatively less extensive. In the typical form, moreover, the muscle fibres appear to form a continuous sheet, but I am not quite confident as regards this point. In the variety, however, it is easy to see in living and even in well-preserved specimens that this muscle consists of a large number of parallel strands lying closely adjacent to one another in a vertical series. I am not referring to the sphincter, which is formed by a folding of the muscle accompanied by a parallel folding of the whole mesoderm, but to the circular muscle of the column below the sphincter.

In the typical form of the species the sphincter is not visible externally and its folds are so shallow and commence so gradually below, that it is difficult to say at what point it begins to become differentiated. This is also the case as regards young specimens of the variety less than five millimetres long; but even in these it is more powerfully developed. In full-grown specimens of the variety, however, the sphincter region can be distinctly recognized externally, forming a somewhat corrugated and rather opaque band beneath the disk, and measuring about one-twelfth of the whole column in length. It is well shown in fig. 5, pl. iii.

The basal sphincter is formed by a few comparatively deep folds in the circular muscle at the base of the column round the periphery of the basal disk. I can find no trace of it in the variety.

Longitudinal muscle fibres can occasionally be detected in the mesoderm of the column in the typical form ; in the variety they are fairly abundant in the spindle-shaped swellings of the mesoderm referred to in a preceding paragraph.

In both forms of the species, the basilar muscles of the mesenteries are well developed, surrounding outgrowths of the mesoderm at the base of these organs and having a dendritic outline in transverse section. As a rule they are developed almost equally on the two sides of the mesentery ; but their exact outline varies greatly even in different mesenteries of the same individual. The basilo-retractor muscles are on the other hand somewhat feebly developed, accompanying a relatively slight folding of the mesoderm often almost indistinguishable. They, too, are very variable. The retractor muscles are stout and somewhat short in transverse section in both forms. In the variety it is possible to distinguish these belonging to the directive mesenteries from the others by their shape as well as by their position and orientation. In transverse section all have a reniform outline but those of the directive mesenteries are shorter and more nearly circular. In the typical form of the species this characteristic is not so marked as in the variety, but in the latter there is more space for the muscles to retain their natural outline than there is in the former. The retractor muscles in the variety become gradually more slender near the base of the column, and practically disappear before the base is reached. In the typical form, however, they extend along the basal disk almost to its centre, and play an important part in the muscularity of that structure.

The radial muscles of the disk and tentacles are at first sight difficult to detect, owing to the fact that they form a relatively narrow band in transverse section. In suitable longitudinal sections of the tentacles, however, they appear to be powerful and are easily distinguished.

Tentacles and disk.—

The arrangement of the tentacles is closely similar in the two forms, but the variety generally has one cycle fewer than the typical form, full-grown individuals of both being examined. Stoliczka said that he could distinguish the six primary tentacles from the others by their shape ; this I have been unable to do, but, at any rate in young individuals, their position surrounding the mouth is quite distinct and they are separated from the other cycles. Typically each cycle, commencing from the primary cycle and going outwards, has twice as many tentacles as the one immediately within it, as Stoliczka's diagram (*op. cit.*, pl. xi, fig. 2) shows very clearly ; but although this holds good as a general rule, there are many exceptions, which arise either from the suppression of some of the tentacles of a cycle or by the appearance of supernumerary tentacles. The latter phenomenon may occur in one of two ways : not infrequently an extra tentacle makes its appearance at the base of one already fully formed than which it is at first considerably smaller, and less frequently a tentacle splits longitudinally into two. I have seen both these methods of multiplication in

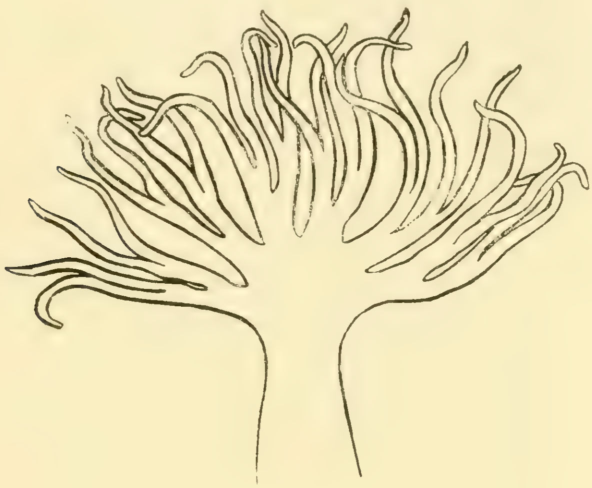


FIG. 2.—Expanded disk of *M. schillerianum* var. *exul*, oblique lateral view, nat. size.

progress in the variety, and have little doubt that they also occur in the typical form, judging from the slight divergencies from regularity which I have found in specimens.

As regards the individual tentacles I can find no difference between the two forms. In both they are elongated and tapering and are perforate at the free extremity. I have on one occasion seen an acontium protruded through the pore. The nervous layer of the ectoderm is clearly marked in transverse sections and the layers are generally of typical form and structure.

The wall of the disk is thinner in the variety than in the typical form. In the latter, when the disk is fully expanded its edge makes a right angle with the column and is entire. This is also the case as regards individuals of the new race of all ages, when their disks are fully expanded. When the disk of the typical form is partly contracted, however a fold of the wall of the column containing the upper extremity of the sphincter makes its appearance, and this is also the case in young individuals of the new race less than about 2 cm. long. Even after the appearance of this "collar," the margin of the disk is entire. In larger individuals of the isolated race, for reasons to be discussed immediately, the collar does not appear in any circumstance, and the margin of the disk is broken up by deep furrows into twelve lobes, each containing seven tentacles and every two corresponding to one of the six primary tentacles. As lobulation of the disk is generally regarded as a character of generic value in the group to which *Metridium* belongs, this is a matter of some importance. It must be noted, however, that the lobulation is not a permanent feature of the species or even of the new race, but only occurs in specimens of the latter which have attained a large size. Probably it is brought about by the nature of the radial muscles and the thinness of the wall. It is not in any way comparable to the shallower lobulation of the disk which characterizes many Actinians, but may be of interest in considering the question of the manner in which such permanent lobulation has come about.

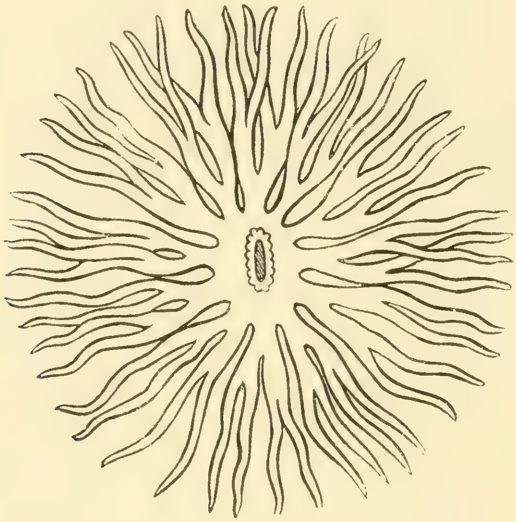


FIG. 3.—Expanded disk of *M. schillerianum* var. *exul*, from above, nat. size. Only the outermost cycle of tentacles is represented.

I have already referred to the fact that no fold makes its appearance round the disk of full-grown individuals of the var. *exul* when they are in the act of contracting, and also that contraction takes a different course in such individuals from that followed in the case of younger examples of the same variety or of either young or old examples of the typical form. When a full-grown typical individual is irritated, the whole disk is drawn downwards by the contraction of the contractor muscles, and at the same time, or a little later, the sphincter, by contracting, draws in the upper part of the column above the disk, while the diameter of the disk and the length of the tentacles are reduced by contraction of the radial muscles, and the mouth is tightly closed. The tips of the tentacles are bent inwards in a broad arc. In young individuals of the variety the process is similar, but the sphincter contracts more strongly. The space in which the disk is to be contained is therefore less, and the tentacles are forced to dispose themselves in a different manner. The outer cycles draw together in such a way that their tips are in contact or almost in contact, while the inner cycles bend downwards and enter the mouth and stomodæum. The difference between the two ways in which space is found for the bestowal of the tentacles during contraction of the disk is strikingly illustrated in bisected specimens of the two forms. In full-grown individuals of the new race, on the other hand, the tentacles and the disk are not withdrawn entirely into the column when the animal is irritated, but, after partial retraction of the disk and contraction of the tentacles, the sphincter contracts below the disk and the mouth is closed, not always very tightly. This difference is connected with a change in habits which will be discussed later.

Basal disk.—

Not the least striking difference between the two forms is that connected with the basal disk ; but as in other characters, the difference in this respect is more marked in fully grown individuals than it is in the young. The base of the typical form is strongly muscular, that of the variety much more feebly so ; but that of young examples of the variety resembles, in its general characters, except in the absence of a sphincter, that of the typical form. In the typical form, the main axis of the base forms a right angle with that of the column, and the edge dividing them is sharply defined. It is possible, however, for the basal disk to be extended beyond the column under certain conditions, as when the animal is stationed in a cavity the diameter of which is greater, but not very much greater than that of its column. The lower surface of the basal disk is always flat as a whole. In young examples of the new race the lower surface of the basal disk is also flat ; but the edges do not appear to be extensile. In well-grown individuals of this form, however, the lower surface of the basal disk is not flat, but either concave or convex in accordance with external circumstances. In fact, it has to a great extent lost its functions as an organ of adhesion, in accordance with the change of habits already alluded to. In both forms of the species, there is a pore in the centre of the basal disk, communicating on the one hand with the cœlenteron and on the other with the exterior.

In young examples of the new race there is a distinct folding of the ectoderm in the neighbourhood of the basal disk, comparable to that which occurs all over the column of the typical form ; while a trace of folding can even be discovered in the former position in the adult of the isolated form. The arrangement of the inferior termination of the mesenteries is very variable in the new race, in which the two mesenteries of a pair often join together and end before reaching the centre of the basal disk, while sometimes they do not meet at all and run right to the edge of the central pore.

Mesenteries.—

The arrangement of the mesenteries in the typical form is, as is frequently the case in the family subject to many minor irregularities ; but it seems to be a fixed rule in the species that only six pairs of mesenteries are complete, and that they are all, occasionally with one or two individual exceptions, fertile. The number of fertile secondary mesenteries is variable ; often none of them are fertile, so that Stoliczka was right when he described specimens as having twelve ovaries. The mesenteries of the secondary cycles in this form are always smaller than those of the primary cycles, and the retractor muscles of the latter are so feebly developed that as a rule they are not visible to the naked eye. Mesenterial filaments, more or less perfect in structure, are usually present in those cases in which it is possible to recognize the retractor muscles ; but some of the mesenteries, in all the specimens I have examined, consist merely of the basilar portion, with which they terminate, neither the membranous part between the proximal termination and the retractor, the retractor itself, nor the filament being represented. In the typical form of the species such imperfect mesenteries occur irregularly ; in one specimen a pair was noted which seemed to represent by itself a cycle of which the other mesenteries were absent. In the new race, on the other hand, it is the rule for all the mesenteries except the six primary pairs to be in this rudimentary, or possibly vestigial condition. Only exceptionally do any of the secondary mesenteries bear retractor muscles, filaments or gonads. This condition of affairs considerably increases the lumen of the cœlenteron, which is further enlarged by another peculiarity namely the thinness of the mesoderm in the mesenteries. In the typical form of the species, this layer rather increases in transverse diameter as it juts out into the mesenteries, and maintains a porportionately considerable breadth the whole way between the basilar and retractor muscles. In the new race, however, although it bulges out and takes on a dendritic form in the region in which it supports the basilar muscles, it decreases greatly in thickness between the distal extremity of the latter and the base of the retractors. Indeed, to such an extent is this the case that in what may be called the membranous part of the mesentery, the mesoderm appears in transverse sections as an extremely delicate filament. There are, of course, differences in the transverse diameter of this layer, so far as the mesenteries are concerned, in different regions of the column ; but the differences just described are very much more conspicuous than any of a local nature.

Both internal and external mesenterial stomata are present in both forms.

The structure of the mesenterial filaments calls for no special remark either as regards the species as a whole or as regards the two forms thereof. It agrees closely with that which has been described by O. and R. Hertwig (3), and subsequently by others, in the cases of different members of the Sagartiidæ. The only points in which these organs appear to exhibit specific interest so far as *M. schillerianum* is concerned, are the extent and number of the folds into which they are thrown both horizontally and vertically, and the great length of the acontia. I can detect no difference, except those already noted, as regards the structure of the mesenteries in the two forms of the species.

Gonads.—

The nature of the gonads in this species is interesting. In most

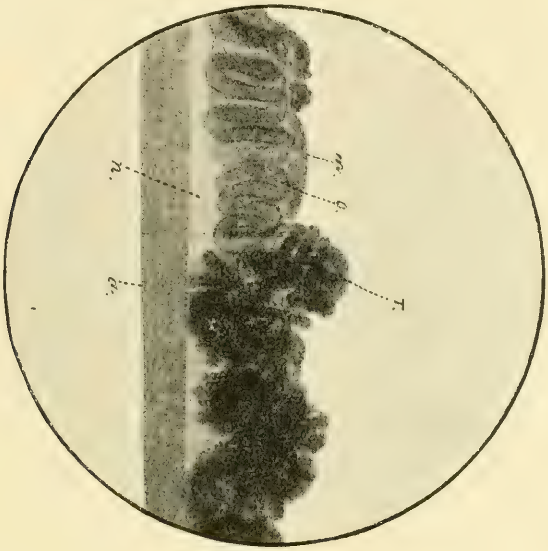


Photo by L. L. Fermor.]

FIG. 4.—Part of the mesentery of *M. schillerianum* var. *exul*, from a preparation in canada balsam, highly magnified. *m* = mesenterial filament; *t* = unripe testis; *o* = ovary; *n* = membranous part of the mesentery; *a* = retractor muscle.

of the Actinians one or other of two conditions is found—either the male and female organs are borne by different individuals, or the two are borne in the same part of the same mesentery of one individual, one sex generally taking precedence in time of the other. In *M. schillerianum*, however, neither of these conditions prevails. In specimens of the variety examined at the beginning of December, only ovaries (which were present in all individuals measuring more than about 15 mm. in length) could be found; they occupied the distal part of the mesentery, extending from the lower extremity of the stomodæum vertically downwards as far as the point at which the structure of the mesenterial filament first underwent a change. Their position on the complete mesenteries corresponded exactly, therefore, with that of the part of the filament which was trilobate in transverse section, and their lower extremity was situated exactly opposite the point at which the ciliated tracts of the filament disappeared. The lower part of the coiled portion of the filament, on the other hand, corresponded with a region of the mesentery containing, at that date, cells with all the characters of sexual cells but as yet of an indeterminate nature. These cells were situated at the base of the endoderm covering the mesentery. The ova were already far advanced in the part of the mesentery occupied by the ovary, and this part of the mesentery had lost its purple colour ; but the lower part, below the ovary, was still of a very deep purple. The structure of the ovary closely resembled (except that the whole structure was strongly folded) that of the ovary of *Calliactis parasitica* as figured by O. and R. Hertwig (3). In specimens of the new race of *M. schillerianum* killed in January, however, the condition of the gonads had altered completely. The upper part of the mesentery was now devoid of ova and was thin and colourless ; the lower part, in which the indeterminate sexual cells had occurred in other individuals a month earlier, was now distended with spermatozoa arranged in approximately quadrangular follicules. Although they were already ripe, the development of the testes had not destroyed the purple colour of this part of the mesentery. The structure of the organs was identical (except for a folding similar to that of the ovaries but even more marked) with that of the testes of *Calliactis parasitica*. In a few individual mesenteries the testes appeared to have invaded that region which had been previously occupied by the ovaries, but the two regions were as a rule distinct, and corresponded to those parts of the mesenterial filaments which I have referred to above. In individuals killed towards the end of March the gonads were again in the same condition as in those killed in December.

Stoliczka states that the eggs have a chitinous covering when emitted, and that there is a dark layer beneath this covering. If his statements are correct, both these structures must come into existence at a very late stage of development, for ova which appear to be of nearly full size show no trace of either. The spermatozoa, as Stoliczka noted, have a round head and a tail of somewhat moderate dimensions. In the testes they are arranged with their heads pointing outwards towards the endoderm which encloses them, and it appears that the movements of their tails prove sufficient to drive them through this endoderm, probably between the cells. Stoliczka's specimen, which threw out part of the gonad, was evidently living under unfavourable conditions, and the process appears to have been pathological. In individuals of the form he described living in my aquarium the gonads degenerated altogether. These individuals were obtained, together with others which were killed and dissected, in the Matla estuary at the beginning of January. The gonads of those which were examined were, at that date, in exactly the same condition as examples of the isolated race from the ponds.

Skeleton.—

In his account of the species Stoliczka stated that it was remarkable in the possession of a skeleton consisting of both calcareous and silicious elements. I have examined both his own specimens and fresh ones, in order to be in a position to discuss this skeleton; but in vain. All that I find is that in some of the individuals examined the cœlenteron is to some extent lined with extraneous particles of silica, which also occur in the mud of the ponds and estuary, and that these particles have occasionally been taken into the cells of the endoderm or even into the mesoderm. It is well known that many Actinians protect themselves by absorbing solid extraneous particles in this way, *e.g.*, the Indian species *Myractis tubicola*, Haddon (6). The calcareous spicule figured by Stoliczka looks very much like that of an Alcyonarian, and some of my specimens of *M. schillerianum* var. *exul*, which were taken from the canals of a Sponge, contain undoubted sponge spicules.

Colour.—

Such coloration as the two forms of the species possess is practically identical and is due to three factors; two of these can be readily explained, while the origin of the third is still obscure.

The most general cause of colour is the presence of zooxanthellæ in the cells of the endoderm of the column and tentacles and of the ectoderm of the stomodæum. These bodies agree in form and structure with those found in other Actinians. In the new race of *M. schillerianum*, and probably also in the typical form, they are not always present. I found at Port Canning in December that they were fairly abundant in individuals from one of the ponds, but were absent from others living in a second pond only divided from the first by a narrow bank. At the same time they were very abundant in examples of the typical form from the estuary; they became far less numerous in the course of a few weeks in the same individuals, which were placed in an aquarium, but again reappeared in large numbers in their tissues before two months were past. The distribution of the zooxanthellæ in the tissues was found to be by no means constant. In individuals living buried in mud it was not surprising to find them practically confined to the tentacles and the upper part of the column. They were also noted occasionally in the mesoderm and even the ectoderm of these regions, and I have seen them on several occasions, as did also Stoliczka, in the cloud of slime and stinging threads shot out from the external surface when the animal was irritated. In the last instance there can be little doubt that they had been squeezed out accidentally. In individuals of the typical form they are as a rule more numerous in the endoderm underlying the sphincter and in that lining the interseptal spaces than elsewhere. They are not altogether absent from the intraseptal spaces, but are sparsely scattered in the cells. To this fact is due in part the presence of the semi-opaque vertical stripes which, in the typical form, represent the intraseptal spaces externally; but the difference between the character of the endoderm of these spaces and that of the interseptal ones is also, to some extent, responsible for this element in the coloration. In the pond race, the scarcity of zooxanthellæ in the column renders the wall of this region more transparent and makes it possible to distinguish the position of the mesenteries externally. The zooxanthellæ are always more numerous towards the distal end of the endoderm cells than at their base, from which, indeed, they are practically absent.

The second factor is not very important so far as coloration is concerned. It consists of irregularly shaped solid particles and globular masses of liquid, both very minute, occurring in the cells of the ectoderm of the stomodæum and the endoderm of the mesenterial filaments. Other particles, possibly of an excretory nature and of a shining white colour, are present in certain cells of the endoderm of the tentacles, giving rise to transverse bars. I can find no confirmation of Stoliczka's statement that these bars are due to accumulations of nematocysts, for nematocysts are equally numerous throughout the ectoderm of the tentacles. When zooxanthellæ are absent from an individual, the solid particles and liquid globules in the mesenteries and stomodæum give these organs a faint pinkish tinge during life. There can be little doubt that such intracellular accumulations of matter are direct products of metabolism.

The third factor is the cause of the purplish colour noted by Stoliczka in the mesenteries of the typical form, and equally conspicuous in some individuals of the new race, but not always present either in the typical form or the other. If any part of the endoderm of an individual with purple mesenteries be examined microscopically, it will be seen to contain numerous bodies of a deep violet colour. With the aid of a fairly powerful objective such as Zeiss' apochromatic D these bodies will be seen to vary considerably in shape and size and each to be enclosed in a green and apparently structureless capsule, the colour of which does not disappear in spirit. An oil-immersion lens is necessary to throw any light on their structure, and even under the highest powers they are minute. Under favourable conditions each body can, however, be seen to contain a large number of smaller, densely pigmented spherical structures, evidently spores, surrounding a colourless central core. I have not succeeded in investigating the structure of the spores owing to their minute size and to the fact that their dense pigmentation is extremely stable. The capsule is pear-shaped or subspherical in most of the bodies, but in the largest its outline becomes irregular; in some cases it is no longer intact and the spores are scattered round it. An examination of a considerable number of sections and other preparations has elicited the following facts as regards these violet bodies.

After the spores have been set free among the cells of the endoderm, they increase in size, and a small, comparatively clear circular space appears in the middle of each. In the centre of this space is a dot so minute that I have not been able to make out its structure. At first it is difficult to ascertain the nature of the envelope in which each of the spores is enclosed, but after they have increased slightly in size it is possible to see that each lies in a capsule resembling that of the parent but exceedingly delicate and only faintly tinged with green.[1] At a slightly later period the capsule commences to bulge out at one pole, and finally forms a projection which may be either pointed or blunt at the free extremity, and is nearly as wide as, and several times as long as the body to which it is attached. It is apparently hollow, and a slight fold or constriction in its wall can generally be detected a short distance from the proximal end. The coloured contents of the capsule are still confined within their original limits, and as yet show no sign of subdivision. The main part of the capsule next increases in size and its contents split up, apparently by fragmentation, into numerous smaller bodies resembling the spore from which the whole structure originated but rather less minute, a colourless residue remaining. Some of these smaller bodies make their way into the hollow projection, and the main part of the capsule gradually becomes less distinct from the projection, which increases in girth; so that the whole structure assumes a pear-shaped or subspherical outline. During this process the products of division divide and become smaller by subdivision. Finally the capsule ruptures and a new generation of spores is set free.

It is obvious that much further study would be necessary before it would be possible to give a name to these violet bodies, and such study would have little bearing, so far as it is possible to see, on the subject of this paper. All that can be said is, that they appear to represent an asexual cycle in the life-history of some minute alga. It is of interest to note that if they are not phases of the same organism as the zooxanthellæ, two symbiotic, or at any rate inquiline, organisms occur together in the inner tissues of the same Actinian.

The position of the violet bodies in these tissues is practically the same as that of the zooxanthellæ, except that the former are inter- not intracellular. They are not, however, sufficiently numerous in the column to give a visible colour effect, and even in the mesenteries, in which they are far more numerous, they only colour the thin membranous part. Stoliczka believed that the deep purple, often seen in the region of the gonads, was directly due to the sexual products. So far from this being the case, I find that when the ovaries are ripe or nearly so, they lose their colour almost completely. The loss of colour, however, is due not to the entire disappearance of the violet bodies, but to the fact they are more widely separated from one another as the eggs increase in bulk and so stretch the endoderm in which the bodies are scattered. It is possible, however, that the growth of the eggs has some direct effect on these bodies, which are so scarce in the spent ovaries that the mesenteries have little colour in this region after the eggs are set free. I have not seen an immature individual with purple ovaries, and the violet bodies are always absent from the acontia.

From what has been said it is clear that neither form of *Metridium schillerianum* owes its coloration to pigment produced by its own metabolism. In both forms the colours are due to independent or semi-independent organisms, and the difference of distribution of these organisms in the bodies of the Actinians is probably connected with biological differences in the hosts.

BIOLOGY.

Relations to environment.—

Stoliczka found the original specimens of the species living attached to logs of wood ; he therefore suggested that they should be called Lignacalephæ. I have recently found specimens of the typical form ensconsed in the dead shells of barnacles fixed to iron posts in the Matla estuary. Stoliczka noted that the species, as he knew it, frequently inserted its basal disk into cavities in the logs to which it attached ; both in the case of my specimens and of his, the basal disk was extended somewhat beyond the periphery of the column to cover the base of the cavity in which the animal was stationed. In circumstances in which it is impossible for the Actinian to protect itself by entering a cavity already formed, for example when it is in a glass vessel, it constructs a protecting sheath for itself out of such objects as filaments of the algæ which grow in its natural habitat. This habit has been exemplified by individuals of both forms recently living in captivity in Calcutta, especially by fully grown individuals of the typical form and by young individuals of the new race. I was able, in the case of one example of the latter, to observe the production of the sheath. The animal had been removed from the aquarium and placed in a watchglass full of water, and was being examined under a fairly high power of the microscope. After a few minutes of complete contraction its column grew slightly longer and at the same time a large number of stinging-threads were emitted from the upper part of this region of the body. These were of simple structure, devoid of barbs. They did not remain still after being set free, but displayed a rapid corkscrew motion closely resembling that of many spermatozoa and were thus carried through the water for a short distance round the Actinian, from which they did not recede. A quantity of mucus was also secreted from the exterior of the column. The rapid movements of the threads did not last for more than a few minutes, but, as they ceased, the threads became matted together with the slime, which retained any extraneous substances that chanced to come in contact with it. Larger examples of the new race, examined as they were taken, had particles of the mud from which they had been removed adhering to them, probably for the same reason ; but in all cases the external coating thus formed was of an extremely evanescent and flimsy nature.

As I have already pointed out, there are few solid bodies at present to be found in the ponds at Port Canning I have searched them in vain for specimens of the typical form of the species, which was living in one of them thirty-nine years ago, when the logs of wood were there. Representatives of the new race now abound, however, in the ponds, with the exception of the two ponds nearest the railway station, both of which are used by the people of the settlement for such purposes as washing domestic utensils and clothes. (There is at Port Canning one large pond which is only separated from the brackish ones by a few hundred yards and yet contains fresh water ; but as the fauna of this pond is of normal character and does not include marine elements, I have not referred to it hitherto and need not do so again.)

Although the typical and the new forms of *M. schillerianum* are alike in producing a temporary sheath of matter secreted by their own cells and mixed with extraneous substances, the new form is not in the habit as a rule of attaching itself by its base to the few inanimate solid bodies to be found in the ponds. *Spongilla cerebellata,* however, often occurs in masses of considerable size in the ponds, and in its canals I have found enormous numbers of young individuals of the Actinian. In the majority of cases these were situated in such a way that their long axes were parallel to those of the canals, to the walls of which they adhered by means of the external surface of their columns. In some cases, however, their basal disks were attached to the shells of small Lamellibranchs (*Corbula* spp.) which also frequent the canals of the Sponge. In situations in which no Sponges were present, the young of the Actinian were generally found attached to the filaments of algæ which formed more or less dense cloud-like masses, and many were also found among the matted roots of grasses. None, however, were found attached to the stems or branches of upright plants such as *Naias*, and it was clear that among the algæ and grass roots a considerable amount of lateral support was given them. When they were placed in a vessel of water without any such artificial support, they proved able to adfix themselves to the bottom by their bases and to stand upright with fully expanded tentacles. In this position they closely resembled the young of the common European *Sagartia troglodytes* and could only be distinguished from small examples of the typical *M. schillerianum* by the greater elongation of their columns and by the thinness of the walls of this region—a feature quite apparent owing to the transparency of the tissues, which permitted the exact position of the internal organs and the movements of the acontia to be observed with ease. Individuals even in this stage, however, rarely lived for long in an aquarium, and at once gathered round them filaments of algæ.

The full-grown individuals of this new race were invariably found buried in mud, in which they were sunk as far as the base of the tentacles, and into which they retreated completely on being disturbed. When removed from the mud their long, vermiform columns were unable to support them in an upright position, and they lay in a glass vessel with their main axes parallel to the bottom, but with the extreme distal end of the column slightly curved upwards. Their attitude and appearance were in fact closely similar to those of many species of *Cerianthus* in similar circumstances. And yet every intermediate stage was to be found between the typical *Sagartia*-like young and the *Cerianthus*-like adult, while the internal anatomy, allowing for differences due to maturity, was found to be identical in large and small individuals. Moreover, although the basal disk had almost disappeared, it had not altogether lost its function as an organ of adhesion, for many large individuals dug from the mud were found on close examination to be adherent by their bases to shells and other small objects. In preserved specimens it would often appear on superficial examination that the basal disk is in much the same condition of atrophy as it is in *Edwardsia* and other burrowing forms, but in living examples it is always clear that this is not the case; in fact, a distinct disk is present (plate iii, fig. 3), but it is relatively small and in other respects degenerate.

Stoliczka noted that the typical form of the species was able to survive exposure to the sun out of water for some hours—a phenomenon which has been recorded in other Actinians—and I am able to confirm his observation. When exposed at low tide the animals remain with their tentacles extruded, and the whole organism has a particularly flabby appearance. A close examination of living specimens under these and other conditions, and a comparison with dead and carefully preserved material, enables me to suggest a reason for the powers of endurance possessed by the typical *M. schillerianum;* possibly this explanation will be found to apply to other species also. I have already remarked on the comparatively thin walls of the column of the new race of *M. schillerianum* as compared with those of the same part of the body in the typical form of the species, and on the fact that it is possible to gauge the thickness of the wall in small living specimens of the former owing to its transparency. The wall of the column in the typical form is usually less transparent than it is in the variety, owing to the large number of zooxanthellæ present in the endoderm; but this very fact makes it possible to estimate the extent to which the thickness of the wall is due to the layers other than the endoderm. This can be done most easily by watching an acontium which is being thrust out of one of the cinclides. It is not difficult to see that the thin white thread has to traverse a considerably greater extent of transparent tissue outside the coloured endoderm than could be accounted for if the thickness of the ectoderm and mesoderm seen in a transverse section of a preserved specimen were the same as the thickness of these same layers during life. The shrinkage, which is inevitable in preserved specimens, is very much more marked in the case of the typical form than in that of the pond race; it is less evident, in the case of the former, if specimens are killed and preserved in weak formol than if they are treated with reagents, such as corrosive sublimate and alcohol, which give a more satisfactory result as regards cellular histology. The reason for this apparently is that an aqueous solution of formol while causing intense muscular contraction during life, does not dehydrate the tissues after death. If a specimen of the typical form which has been preserved in formol be cut in two with a razor, so as to disturb the tissues as little as possible, it will be found that the ectoderm is not closely folded as it is in a specimen preserved in spirit or even in one which has been killed in formol and then dehydrated in alcohol and embedded in paraffin; but that there are large spaces between this layer and the mesoderm, the two layers being only in contact at widely separated points and there being a considerable amount of liquid enclosed between them. The same condition, but not nearly to the same extent, will be found to exist in young individuals of the new form, while, except in the lower part of the column, it will not be detected in full-grown examples of this form. In the neighbourhood of the basal disk of these, however, it exists to a slight extent. In specimens of the typical form which have been long in alcohol, as I found in the types of the species, the ectoderm shrinks very greatly (apparently more so than the mesoderm does) and therefore comes to be nearly smooth again, lying parallel to the mesoderm. From these considerations I conclude that there is naturally a layer of water between the ectoderm and the mesoderm in the typical but not in the new form of *M. schillerianum*—there are traces of it even in the adult, and much more clearly in the young, of the latter—and further that the folds of the ectoderm which are so striking a feature of this layer in sections of the typical form (plate iii, figs. 5, 6) of the species, are artificial.

As to the function of this layer of water, which is confined to the column: I would suggest that it is to enable the Actinian to endure exposure to the sun out of water. The form is one which haunts tidal waters and, as Stoliczka noted, has a great tendency to maintain its position near the surface and to return to that position if removed from it. In the small cavities in which it is frequently found ensconced, a certain amount of water remains when the object in which they occur is left dry as a whole by the retreating tide. If the animal is able to make use of this water by drawing it into its body, as it may do by means of the cinclides, the habit of living in such cavities must benefit it in more ways than one. My reason for saying that it is possible that other species make use of subectodermal spaces in the same way as the typical form of *M. schillerianum* is that I have observed in specimens both of this form and of *Sagartia troglodytes*, *Actinia mesembryanthemum* and other British species (especially when they are living under unnatural conditions in foul water) that blister-like projections appear on the column, most commonly towards its base, and that in the case of the Indian form these projections, which remain in specimens preserved in formol, are due to accumulations of liquid below the ectoderm. It is difficult to make observations as regards the exact relation of one layer of the body to another on living material, for the whole organism is so highly contractile that such relations are distorted immediately on the application of a sharp instrument to the external surface; but water certainly exudes in considerable quantities from the wall of the column of a living example of the typical *M. schillerianum* which is cut with a razor.

The pond race of the Actinian is not subject to the same periodical exposure as the typical form of the species, for under ordinary conditions it lives beyond the reach of the tides. It is, however, exposed to gradual changes in the salinity of the water to which it is restricted. To what extent it is able to survive such vicissitudes is still uncertain[1]; if Stoliczka is right as regards the chitinous nature of the membrane which covers the egg of the typical form, and if the egg of the pond race has a similar covering, the egg is well fitted to withstand chemical changes in the environment, and even desiccation. Adults of the pond race are able to live for some hours lying on the ground exposed to the sun. Under such conditions their behaviour is totally different from that of examples of the typical form. I have found individuals of moderate size lying on the mud at the edge of a tank. Their tentacles were completely retracted and the sphincter was tightly closed; their columns were, however, distended with water, which was contained in the cœlenteron.

Under natural conditions both forms of the species are diurnal in habit, the typical form remaining with its disk fully expanded when exposed to the direct rays of the sun. The new race, however, is usually found below or among floating algæ according to its age, and these provide considerable shade. Young and half-grown individuals in my aquarium became practically nocturnal after a few days' exposure to bright light in a glass vessel. At night and early in the morning they expanded their tentacles, which were withdrawn as soon as the day became warm (*cf.* Fleure and Walton (12), p. 217). Individuals of the typical form living under identical conditions exhibited a similar tendency, but to a less marked degree; full-grown examples of the race never lived for at most more than three days in these conditions. Young examples of this form showed less power of resistance to the unnatural conditions of a small aquarium than did adults of the typical form, the latter living for over three months in water which was always kept of the same salinity, while those from the pools, in the same vessel, as a rule died in about a fortnight. The water in which they were, was taken from one of the ponds at Port Canning and was brought to Calcutta in a stoppered bottle.

Movements.—

Notwithstanding what appears to be an avoidance of bright light in the case of the variety, neither form of the species exhibits any marked heliotropism, negative or positive, in its movements. When individuals are placed in a glass vessel lighted from one side, they remain, other conditions being suitable, where they are placed, neither moving towards the light nor away from it. Stoliczka noticed, however, that his specimens showed a tendency to move upwards towards the surface of the water, and I find that mine prefer

[1] Almost at the end of the hot weather, the Actinian is still abundant in the ponds. May 27th, 1907.

to become stationary on the sides rather than at the bottom of the aquarium, unless they are given empty shells, in which they ensconce themselves at the bottom.

Both forms possess considerable powers of progression, but they do not habitually move in the same way. The only method I have seen the typical form adopt is that observed by Stoliczka *viz.*, by crawling slowly on the basal disk along a vertical or horizontal surface. This method of progression is effected partly by alternate contractions and expansions of the disk, and partly by a copious secretion of very tenacious mucus from the glandular cells which abound on this disk and round the base of the column. It is a slow and feeble one, as it generally is in Actinians ; Stoliczka records that a specimen in his aquarium moved 7 inches in 24 hours, while one in mine took three days and nights to move half the distance.

Possibly the young of the pond race may adopt the same method of progression occasionally, but as a rule they drag themselves along by their tentacles—a much more rapid method. A tentacle is stretched out to its greatest length, until it becomes filamentous. Some part of its surface is then applied to a fixed object, and a gland cell in the neighbourhood secretes a drop of mucous secretion, which fixes the tentacle to the object. The tentacle thus fixed contracts, dragging the whole animal forward as it does so ; the strain on its surface being considerable, the cells in the neighbourhood of the gland are drawn out into irregular projections at the points at which they are held by the mucus. Lately I have observed the same phenomenon in the tentacles of *Hydra*, and I have little doubt that this is the true explanation of Zykoff's statement that the ectoderm cells of the tentacles of *Hydra* put out pseudopodia which are used in progression (*Biol. Centralblat.*, xviii, p. 272, 1898). When the tentacle is dragged away after a forward movement of the organism, the false pseudopodia naturally appear in an exaggerated form ; they are not due directly to movements of the protoplasm of the cells, but to a mechanical strain on the external surface of these cells. I have been able to observe this method of progression in the case of very young individuals of the Actinian under a fairly high power of the microscope. Although the tentacles play in it the most important part, the walls of the column are also adherent to the surface along which the animal is travelling, and if it is moving vertically up the walls of an aquarium, as I have occasionally observed it to do, the "suckers" can be seen to be applied to the glass very closely. They do not appear to be at all markedly concave on the surface, however, as would be the case if they actually functioned as suckers.

In addition to this mode of progression with the aid of the tentacles and the surface of the column, individuals of the variety exhibit, at all ages, strongly marked muscular movements of the column wall. It is evident that the separation of the circular muscle of this region into separate circular strands is physiological as well as anatomical, for it is possible for each strand to contract independently of the others, so that the column appears just as though an extremely fine thread were drawn tightly round it at one point (see plate iv, figs. 3, 4). Although any one of the strands can contract in this way without affecting the others, I have observed under the microscope that they very frequently contract rhythmically and in regular succession from below upwards. What happens is this : The pore in the centre of the basal disk is opened and water is drawn into the lumen of the disk, which becomes bulbular, the circular muscle strands at the base of the column being strongly contracted above it. Then the pore is closed, the lowest muscle strand relaxes and the second one above it contracts. Then the second strand relaxes and the first contracts again, and, as the process is continued up the column, the water is gradually driven up towards the mouth, just as though it were being squeezed upwards in an indiarubber bag by drawing tight and loosening in regular succession a series of elastic rings. I have little doubt that it is by such means that the Actinian is able to rise to the surface again after it has sunk into the mud ; but I have only been able to observe such movements in the case of young individuals which had not yet begun to burrow. In their case the movements assisted them in making their way through a tangled mass of alga filaments. The foot of adult individuals of this variety is probably used for burrowing, aided by contractions both of the circular and the retractor muscles ; but owing to the difficulty experienced in keeping such individuals in a healthy condition after they have been removed from their natural habitat, I have no direct observations to offer on this point. When large individuals are removed from the mud, the contractions of the column which take place are very marked, but entirely lack co-ordination.

Food.—

Judging from dissected specimens, the food of the pond race consists very largely of minute univalve Molluscs, the shells of which are ejected after the animal has been absorbed, and of small fish such as *Haplochilus melanostigma* and *Gobius alcockii*. Stoliczka found that the typical form eat Crustacea in captivity, but I have no information as to its natural food.

RELATIONS OF THE VARIETY TO THE TYPICAL FORM.

In order to make this question clear it will be well to commence its discussion by summarizing the resemblances and differences between the two forms (*a*) as regards their physical structure, and (*b*) as regards their habits.

Physical resemblances between the two forms.

1. The coloration is practically identical.
2. The arrangement of the tentacles and mesenteries is the same.
3. The position of the circular and radial muscles is the same.
4. The structure and nature of the gonads are the same.
5. The retractor muscles are closely similar.

6. The outline of the sphincter is almost the same.
7. The number and position of the mesenterial foramina are the same.

Physical differences between the two forms.

1. The column is much longer in the variety than in the typical form.
2. Its wall is thinner during life.
3. There is one cycle of tentacles and mesenteries less in the variety than in the typical form.
4. A larger number of mesenteries are usually rudimentary in the variety than in the typical form.
5. The mesoderm of the mesenteries is thinner in transverse section in the variety than in the typical form and a larger number of mesenteries are degenerate.
6. There is no basal sphincter in the variety.

In these lists only the resemblances and differences which appear to be constant throughout life are noted. The following are differences which are only apparent in full-grown individuals :—

1. There are no muscle spaces in the sphincter of the typical form, while these spaces occur in small numbers in the adult of the variety but are absent in its young.
2. The adult of the variety is unable to withdraw its tentacles into its body, while the young of the same form and the adult of the typical form can do so.
3. The adult of the variety is unable to stand upright on its base, while the adult of the typical form and the young of the variety can do so.
4. The disk of the adult of the variety is broken up into lobes; but this is not the case in the young of the same form or the adult of the typical one.

Biological differences between the two forms.

The habits of the two forms are totally unlike. The typical form lives in tidal waters, attached to solid objects; but it was also found formerly in an isolated pond. The variety is apparently confined to isolated ponds, the water of which sometimes contains as little as 0·22 % of soluble solids ; the young live among grass-roots and filamentous algæ, or in the canals of Sponges, the adults buried in the mud. Individuals of the typical form can live in water of the same salinity as that of the isolated ponds in which the variety occurs but are not now found in these ponds, from which the solid objects to which they were formerly attached have disappeared. The movements of the variety are more active than those of the typical form, in accordance with the different mode of life adopted.

The most striking differences externally visible between the two forms are the great relative length of the column and the degeneracy of the basal disk in the pond race. I do not know of any other form of the genus in which these characters are so strongly marked; but many instances among the Actiniaria could be adduced in which there is a considerable tendency to variation as regards them. Anyone who has observed living examples of the common British *Sagartia troglodytes* from different parts of the country, or even from different situations in the same locality, must have been struck by the differences they exhibit as regards the form of the column and the relative proportions of its base. Those individuals which have been extracted from small crevices in rocks have a long, thin column and a base with a small transverse diameter, while those from pools with smooth bottoms are short and squat. In Gosse's *History of the British Sea-Anemones* (1) figures are given of the species in the latter condition. As regards outline at any rate, these figures are accurate; but they are as unlike as they could well be to some individuals I have seen. Moreover, I have noticed that in such cases the column cannot adapt itself, except to a limited extent, to new conditions, even although the individuals may be kept alive for many years in captivity. Those individuals which have been living in small round holes such as are a favourite station for the species, cannot assume the depressed conical form that characterizes those which have been fixed to a smooth surface; but those which have been taken from the latter situation are able to elongate their columns considerably and to draw in the projecting margin of their bases. In other British species differences, which may be local, have been recorded, *e.g.*, Dixon (5) states that specimens of *S. nivea* from the east coast of Ireland are much longer and more attenuated than those described from Torquay, on the south coast of England, by Gosse. From Indian seas Alcock (7) has described a variety of *Sphenopus arenaceus* in which the base of the column is drawn out into a relatively long and narrow peduncle.

In none of these cases has the basal disk become degenerate to the same extent as it has done in the tank form of *M. schillerianum*, for there is no basal disk in the genus *Sphenopus;* but in other respects the variation seems to be of a similar nature. It must be remembered, moreover, that there is a great difference, in respect to the condition of the base, between the young and the adult of *M. schillerianum* var. *exul*, as well as in respect to the proportions of the column. It must further be borne in mind that this Actinian lives in a medium the chemical constitution of which is different from that of the medium proper to its class, and there is very good reason to believe that a chemical stimulus may be a powerful one in matters of variation. The particular direction which evolution has taken in respect to this isolated race, moreover, is one which has not been uncommon in the history of the sub-class to which *M. schillerianum* belongs, for we get forms as distinct from one another morphologically as *Edwardsia, Cerianthus* and *Peachia* all adapted in a similar manner to become burrowing animals, and all in consequence having a considerable external resemblance both to one another and to the form under consideration.

The differences which the two forms of *M. schillerianum* exhibit as regards their muscles and mesenteries are perhaps of more importance, from the point of view of the systematist, than the differences in the general appearance and shape of the animals. The muscular differences, however, all seem to be what may be called rather dynamical than morphological. The position of the muscles as regards the layers of the body is identical in the two forms, but in var. *exul* they appear to have become strengthened in certain directions and weakened in others, in accordance with a complete change in the mode of life. Although the mesoderm of the mesenteries is much thinner in the new than in the typical race, and the secondary mesenteries are in a much earlier stage of development as regards their whole form and structure, I think that a similar explanation is possible, for this change is, like that of the muscles, one of development. The mesenteries have not evolved new characters in the isolated race but remain throughout life in a condition through which they pass at an early age in the typical form, and it is obviously a convenient condition as regards the bionomics of the race. This explanation does not quite apply to the thinness of the mesoderm in mesenteries which are just as long as they are in the typical form of the species ; but seeing that one of the most striking biological modifications of the isolated race is the use to which it puts the liquid contained in its cœlenteric cavity, it is not difficult to see that the pressure of this liquid must have, in the case of the individual, considerable influence on the growth of the mesenteries.

It is noteworthy that those structures which have the same function in the two forms have undergone very little change in the isolated race. This is particularly true of the tentacles and stomodæum. Indeed, the last-named structure offers so little of interest in connection with the special line of study embodied in this paper, that I have barely referred to it except in the brief systematical description of the two forms. I ought to say, however, that while it is actually longer in the case of a full-grown example of var. *exul* than it is in one of the typical form of the species, the elongation is by no means proportionate to that of the columns as a whole. The reduction in the number of tentacles and mesenteries exhibited by the isolated race, is clearly related to its narrow, elongated form.

In dealing with the question of the modifications which the Actinian of the Port Canning ponds has undergone, it is not by any means easy to apportion the degrees in which these modifications have affected (*a*) the individual and (*b*) the race. It is known that individuals of the same family (*e.g.*, in *Sagartia troglodytes*) have lived for over fifty years (see Ashworth and Annandale [9]), but such instances, as Hickson (11) has recently pointed out, are only known in the case of captive specimens, which have received regular food and lived a sheltered life. Considering the vicissitudes to which they are exposed in the ponds at Port Canning, it is very improbable that any of the individuals now living in these ponds have survived for so long a period, while the presence of numerous young in the ponds and of ripe gonads in the adults proves that we are dealing with a race and not merely a collection of infertile individuals. The modifications are undoubtedly less marked in the young than they are in their parents, between which and the typical form the young are intermediate. This is true as regards biological as well as structural characters. The youngest individuals of the typical form I have seen (measuring about 4 mm. in height) have had a considerably shorter column than examples of the isolated race with disks of a smaller diameter.

Variation has been little studied in the Actinians, which do not make satisfactory specimens either for the museum or the laboratory; but the stony corals, in which the skeleton preserves in many respects a complete diagram of the living tissues, prove how variable certain genera and species of Zoantharia can be (for example see Bernard on *Porites* in the *Catalogue of the Madreporarian Corals in the British Museum*, vol. v, 1905). I doubt whether Gosse was so far from the truth as later systematists believe him to have been when he laid stress on the importance of the study of the living organism in the case of the Actinians. It is worthy of note that, at any rate as regards the Sagartiidæ, the descriptions of genera have recently shown a tendency to become more rather than less indefinite. Compare, for example, Hertwig's (4) definition of *Sagartia*, published in 1882, with Haddon's (8), published in 1898, or with McMurrich's (10), published in 1905, having regard to the fact that these authors are in substantial agreement as to the species which should be included in the genus. As the three diagnoses are short, they may be quoted in full :—

> "*Sagartiidæ* with smooth walls and numerous powerful tentacles arranged in several rows ; with circular oral disk ; without anatomically perceptible cinclides." (Hertwig, 1882.)

> "*Sagartiinæ* with a smooth body-wall, or with small verrucæ in the upper portion of the column ; moderately long tentacles in several cycles around the margin of the oral disk, which is not greatly expanded." (Haddon, 1898.)

> "*Sagartiinæ* with the column smooth or provided with verrucæ in its upper portion ; cinclides more or less scattered ; acrorhagi wanting ; margin not lobed." (McMurrich, 1905.)

The diagnoses of the family and sub-family given by these authors are still more diverse, but the point I wish to bring out is the way in which various descriptions illustrate the necessity felt by recent authorities for broadening the diagnoses of Actinian genera.

Granted that *Metridium schillerianum* var. *exul* is an isolated race of the species to which I have referred it, it still remains to be discussed whether this race has become differentiated in the ponds at Port Canning, and how long the process of its evolution has taken to reach the present stage. The historical evidence on these points, although it cannot be called absolutely conclusive, is much stronger than such evidence usually is. Stoliczka's account of the typical form of the species was written in 1868 (at which date the extent and number of the ponds were probably not the same as they are today) and was more detailed than any dealing with the Sagartiidæ which had previously appeared, although it contained a number of misconceptions rather than errors of observation. Its author was a trained and cautious observer and apparently examined the ponds at more than one time of year. It is improbable that he only did so on occasions when the water had been rendered turbid by rain. Except under these conditions he could not have failed to see the Actinians, had they occurred in the ponds; nowadays they are the most characteristic feature of the fauna to which they belong, and strike even a casual observer. Native fishermen at Port Canning volunteered the information, when I asked them about the fish in the ponds, that there was in the mud "an animal just like a flower." It is unfortunate that we do not know in which of the ponds Stoliczka found the Actinian, but I suspect that it was the one nearest to the railway station. Its usage for domestic purposes has now rendered the water of this pond foul. Stoliczka said that the Actinian did not live in the other ponds at Port Canning because they did not contain logs of wood, and because their water was unsuitable. The last statement is not explained. The logs of wood no longer exist, and their place has not been taken by other solid substances to which the animals might have attached themselves. It has been shown that the race of the Actinian now found in the ponds does not attach itself to fixed bodies, but has become adapted for a burrowing life. So far as the neighbourhood of Port Canning is concerned, I feel sure that this new race is only to be found in the ponds; but our ignorance of the Actiniarian fauna of the Indian seas makes it impossible to deny that an identical form may occur elsewhere. Even should this prove to be the case, however, it would not necessarily be uncritical to argue that similar causes have produced convergence among the offspring of different individuals.

However, it is perhaps better not to introduce questions of possibility; my object in this paper has been to give an unbiassed account of the differences and resemblances between two Actinians which I take to be no more than races of a single species. One of these races has been isolated in certain small ponds, in which it appears to have responded to its environment to such an extent as to have altered very considerably both its structure and its mode of life.

LITERATURE.

1. Gosse, P. H. .. "A History of the British Sea-Anemones," 1860.
2. Stoliczka, F. .. "On the Anatomy of *Sagartia schilleriana*," etc., *Journ. Asiat. Soc. Bengal*, part 2, xxxviii, 1869.
3. Hertwig, O. and R. .. "Die Actinien," *Jen. Zeitschr. f. wiss. Zool.*, xiii, p. 457, 1879.
4. Hertwig, R. .. "Actiniaria," *Zool. Rep.* H.M.S. "*Challenger*," vol. vi, 1882.
5. Dixon, G. Y. .. "Remarks on *Sagartia venusta* and *Sagartia nivea*," *Proc. Roy. Dublin Soc.*, vi (N.S.), 1888.
6. Haddon, A. C. .. "Two species of Actiniæ from the Mergui Archipelago," *Journ. Linn. Soc.*, xxi, 1889.
7. Alcock, A. .. "Some Actiniaria from Indian Seas," *Journ. Asiat. Soc. Bengal*, part 2, lxii, 1893.
8. Haddon, A. C. .. "The Actiniaria of the Torres Straits," *Sc. Trans. Roy. Dublin Soc.* (2), 1898.
9. Ashworth, J. H., and Annandale, N. .. "Observations on some aged specimens of *Sagartia troglodytes*," etc., *Proc. Roy. Soc. Edin.*, xxv, 1904.
10. McMurrich, J. P. .. "The Actiniæ of the Plate Collection," *Zool. Jahrb.*, Suppl vi, 1905.
11. Hickson, J. J. .. "Cœlenterata and Ctenophora," *Cambridge Natural History*, vol. i, 1906.
12. Fleure, H. J., and Walton, C. L. .. "Notes on the Habits of some Sea-Anemones," *Zool. Anz.*, xxxi, 1907.

(Only those works which are directly referred to in the text are noted in this list. Full bibliographies on the group will be found in papers Nos. 8 and 10, while several species are recorded for the first time from Indian seas by Southwell in Herdman's "Faunistic Results" in *Ceylon Pearl Oyster Fisheries and Marine Biology*, part v, p. 441 (1906)).

PLATE III.

EXPLANATION OF PLATE III.

Figs. 1, 2.—Typical form of *Metridium schillerianum*, × 1 (after Stoliczka).

Fig. 3.—Pond race of *Metridium schillerianum* in a contracted condition, × 1 (*ad nat.*).

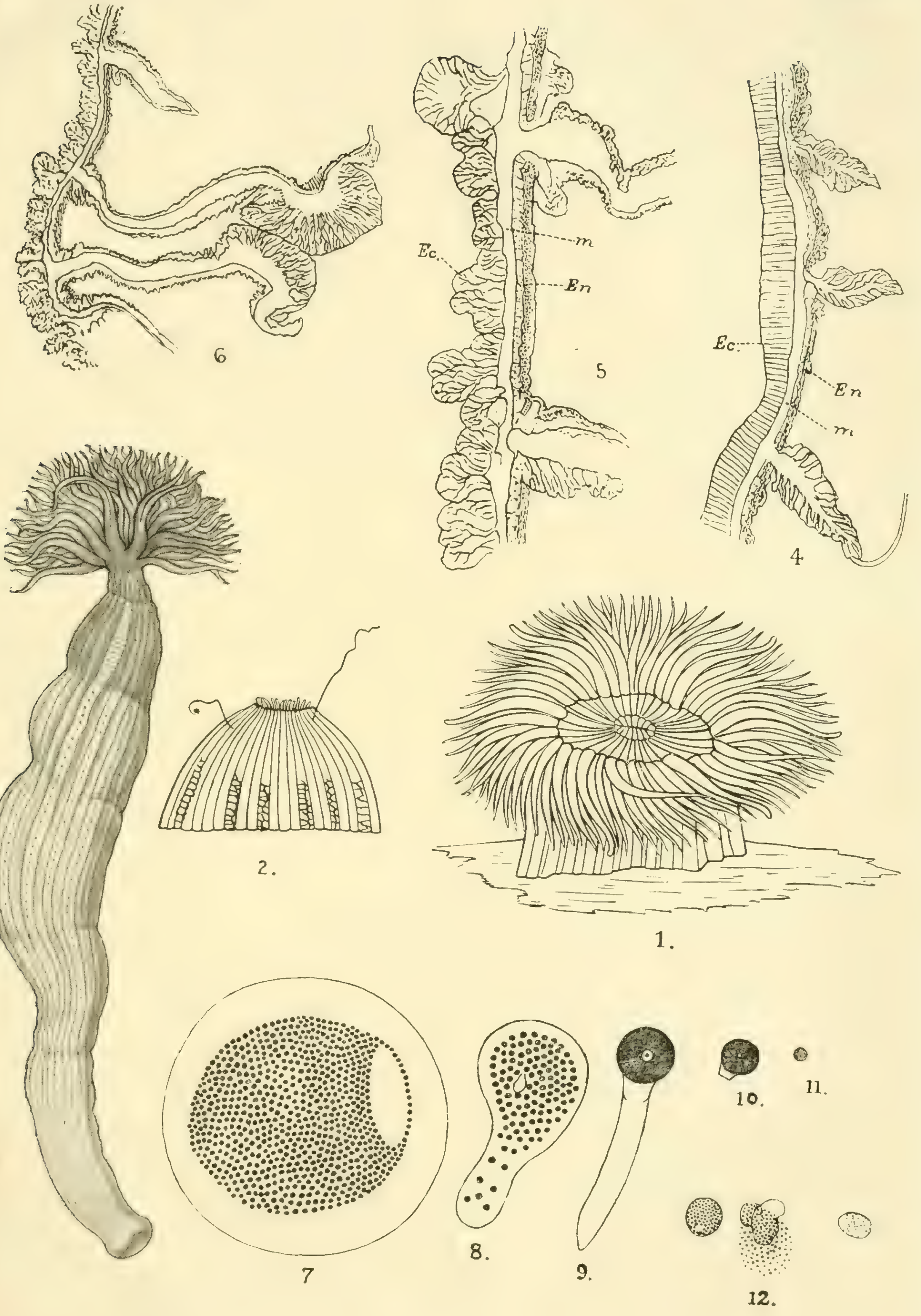
Fig. 4.—Transverse section of wall of column of *M. schillerianum* var. *exul* in the region of stomodæum (magnified).

Fig. 5.—Transverse section of wall of column of the typical form of *M. schillerianum* (at the same magnification as fig. 4).

Fig. 6.—Ditto (less highly magnified).

Figs. 7–12.—Stages in the development of the violet bodies of *M. schillerianum* (enormously magnified). Figs. 7–11 are diagrammatic.

Ec.=ectoderm : *en.*=endoderm : *m.*=mesoderm. The endoderm in the figures is apparently divided into two layers, but this is due to the almost complete absence of zooxanthellæ in the basal part of the cells.


6
Ec.
m
En
5
Ec.
En
m
4
3.
2.
1.
7
8.
9.
10.
11.
12.

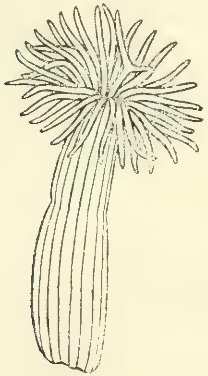


FIG. 1.

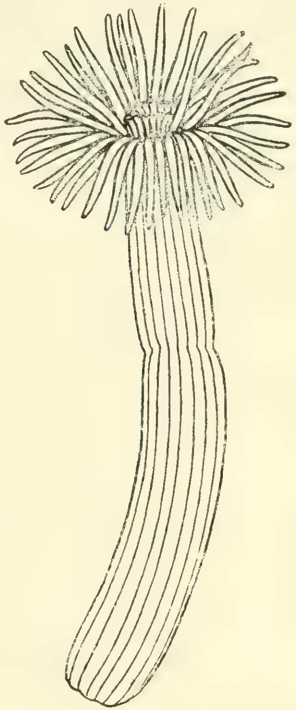


FIG. 2.

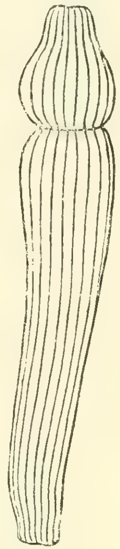


FIG. 3.

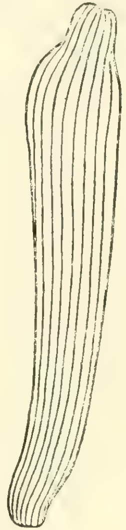


FIG. 4

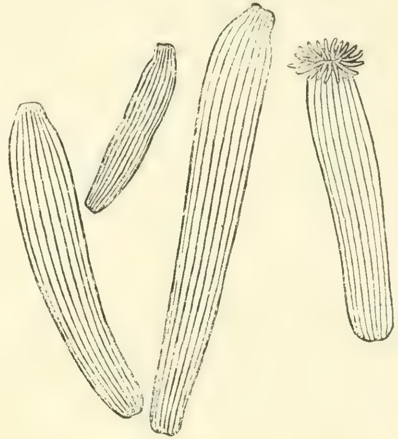


FIG. 5.

YOUNG INDIVIDUALS OF *Sagartia schilleriana* var. *exul* IN DIFFERENT STAGES OF CONTRACTION, all × 4.

Fig. 1 represents an individual which is rather shorter than usual just beginning to expand its tentacles. One of the tentacles is dividing longitudinally. Fig. 2 shows a slightly older individual in which the tentacles are more nearly but not quite fully expanded. Note the open mouth from which the inner tentacles have just been withdrawn. Figs. 3 and 4 represent the same individual in a contracted condition, fig. 3 having been drawn about five minutes later than fig. 4. Fig. 5 shows a group of still younger individuals, all having pressed themselves against the side of an aquarium. All the specimens figured were standing upright.

A SPOROZOON (*SARCOCYSTIS*, SP.) FROM THE HEART OF A COW IN CALCUTTA.

By G. C. CHATTERJEE, M.B., *Assistant Professor of Pathology, Calcutta Medical College.*

In searching for Pirosoma in a blood-smear from the heart of a cow killed in Calcutta, I lately found numerous sickle-shaped bodies which were at first sight very puzzling. These bodies took the Leishman stain, with which the smear was stained, very well. One end, however, took no stain, this end being pointed. The other end was rounded and stained deeply, taking the blue stain. In this end a not very definite nucleus could be made out, and a number of red-stained chromatic dots. The middle of the body stained red deeply. The appearance of these bodies suggested that they were spores of some Coccidium, and on referring to Minchin's (A) account of the Sporozoa in Lankester's *Treatise on Zoology*, the resemblance between them and the spores of *Sarcocystis tenella* (*op. cit.*, p. 305, fig. 122) was at once evident.

In part of the smear a considerable number of straight forms were seen, and in addition to these, two varieties of spores could be made out, being differentiated from one another by the arrangement of the chromatic dots. In a few cases the capsule was found to have burst and the contents were escaping.

On making a section of the heart muscle of the same animal as that from which the smear had been made, and on staining this section with thionin and eosin, my supposition that the bodies were spores of some Sporozoon was confirmed, for numerous cysts were found occupying the substance of the muscle. These took the blue stain, while the rest of the tissue took the eosin. On examining the sections under a high power, I found that the cysts occupied the substance of the muscle fibres, displacing the nucleus. A distinct capsule was a noticeable feature of the cyst. No fine radiation, however, such as is found round the capsule of *Sarcocystis tenella*, could be detected. The identity between the spores, numbers of which occurred in each cyst, and those seen in the smear was evident. The spores were found grouped in loculi, but no distinct alveolar partition could be made out. All the cysts were in the same stage of development, and no intermediary stages were found.

Representatives of the Sarcosporidia are not very uncommonly found in the striated muscle-fibres of Mammals, especially in those of the pig and the sheep. That found in the sheep goes by the name of *Sarcocystis tenella*. One has been found by Hessling in the skeletal muscle of *Bos taurus*. Vuillemin (B) reports a case of infection in the muscle of a man and is of the opinion that the parasite was *S. tenella.* Von Linstow (C) has described a form (*Balbiana* (*Sarcocystis*) *siamensis*) from the tongue of a buffalo in Lower Siam, and Shipley (D) has figured this form. Shipley (E) has also described another form from the muscle of a cow in Ceylon, regarding it as identical with *S. tenella.* Willey, Chalmers and Phillip (F) report frequently infection in the voluntary muscles of buffaloes which are apparently healthy. They found the parasite in 5·8 per cent. of the individuals slaughtered in Colombo.

Regarding the classification and nomenclature of the Sarcosporidia found in different animals, there is a great deal of confusion, as an illustration of which I cannot do better than quote Minchin's remarks (*op. cit.*, p. 308) on the subject. "*Sarcocystis*, Ray Lankester, 1882," he says, "represents the characters of the order. A great number of forms have been seen in different animals, many of which are probably distinct species, but only a few have received specific designation : such are *S. miescheriana* (Kühn) from the pig ; *S. tenella*, Raillet, from the sheep ; *S. platydactyli*, Bertram, from the gecko ; *S. muris*, Blanchard, from the mouse, etc."

21*st February*, 1907.

LITERATURE.

A. Minchin on the Sporozoa in Lankester's *Treatise on Zoology*, part i, fasc. ii, 1903.

B. Vuillemin, *Compt. Rend. de l'Acad. des. Sci. Paris*, cxxxiv, No. 20, p. 1132, noted in Baumgarten's *Jahresbericht* for 1905.

C. Von Linstow, "Parasiten, meisten Helminthes, aus Siam," *Archiv. f. Micr. Anat.*, Bel. lxxii, 1903.

D. Shipley, on the Ento-parasites collected by the Skeat Expedition in the year 1899-1900, *Proc. Zool. Soc.*, 1903 (2).

E. *Idem*, "Some Parasites from Ceylon," *Spolia Zeylanica*, vol. i, 1903.

F. Willey, Chalmers and Phillip, "Report on parasites in the carcases of buffaloes at the Colombo Slaughter-house," *Spolia Zeylanica*, vol. ii, 1905.

MISCELLANEA.

MAMMALS.

THE APPENDICULAR SKELETON OF THE DUGONG (*Halicore dugong*).—In a recent note on the Dugong of the Gulf of Manaar (*Journ. Asiat. Soc. Bengal*, 1905, p. 238) I expressed an intention of dealing with certain anatomical points in a subsequent communication. As, however, most of these points have since been elucidated in a series of memoirs by Messrs. H. Dexler and L. Freund (see Wiegmann's *Archiv fur Naturgeschicte* for 1906, vol. i, p. 77, and the *American Naturalist*, vol. xi, pp. 49 and 567, 1906), further descriptions are unnecessary : these authors' observations were made on Australian specimens, but I cannot detect any constant difference between the races of *Halicore* found in Australian and in Indian seas. There are two features in the skeleton, however, to which I would like to invite attention, namely (*a*) the presence of three distinct bones in the pelvic girdle, and (*b*) the variability of the manus.

(*a*) In recent accounts of the vestigial pelvic girdle of the species two bones are said to be present (see Weber's *Die Saugetiere*, p. 732, fig. 526). In a large Australian ♂ skeleton, however, and in an individual of the same sex and approximately the same size dissected by myself on the Madras coast, I find that there is a third bone, which lies at the distal extremity of the lower of the two

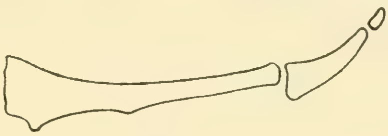


FIG. 1, × $\frac{1}{6}$.

already recognized. It is compressed and nail-shaped, measuring about 15 mm. in length and 6 mm. at the proximal end in breadth. The relations of the three bones to one another are represented in the accompanying diagram (fig. 1). There is probably a considerable amount of variation as regards the form and size of the three bones, but this is a question on which the material at my disposal affords little information.

(*b*) I have examined the manus of the two specimens already referred to, as well as that of several other individuals in which it is imperfect, while I am indebted to Sir William Turner and Prof. D. J. Cunningham for photographs of a specimen in the Anatomical Museum of the University of Edinburgh and to Dr. A. Willey for a sketch (fig. 4) of the hand of an adult female in the Colombo Museum. An examination of this material proves, as is well shown in figs. 2, 3 and 4, that the bones vary in number and relative development

Although all the specimens I have seen, or regarding which I have received detailed information, have been fully adult, probably measuring between nine and ten feet in length in the flesh, the degree to which ossification has progressed is very variable and the hand seems to be smaller in some individuals than in others of the same size. The first digit is always less well-developed than the others. In some individuals it consists of a short oblong or triangular bone, often more or less irregular in outline ; in others in which it is represented by

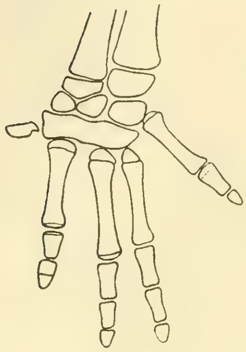


FIG. 2, $\frac{1}{6}$.

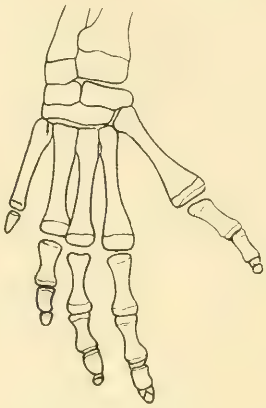


FIG. 3, $\times \frac{1}{6}$

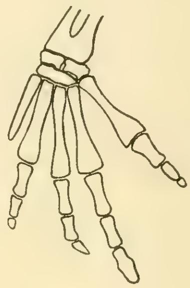


FIG. 4, $\times \frac{1}{6}$.

a single bone, this bone is long and styliform ; while in others again there are two bones, the distal one being short and nail-shaped. The other digits show similar variations but not to the same extent. The bones of the carpus vary chiefly as regards anchylosis. Those in the distal row are used together, probably in all cases; but in the proximal row there may be either two or three bones present. In the latter case it is the scaphoid which is distinct from the lunate bone. The figures, which are outlines of actual specimens reduced to one-sixth the natural size, illustrate these variations very clearly, fig. 3 showing, further, the actual relations between the fourth and fifth digits—a feature which is not always correctly represented.

N. ANNANDALE.

BIRDS.

EGG LAID BY A CAPTIVE GOSHAWK (*Astur palumbarius*).—Lieutenant-Colonel Phillott has recently sent to the Museum the egg described in the following note. It measures 50 mm. in length and 40 mm. in greatest transverse diameter ; the colour is a clear, pale green, the outline regular.

"My friend Miyān Mahmūd Sahib-zada of Taunsa, Dera Ghazi Khan, has sent me a Goshawk's egg laid by a trained bird which had been in confinement for sixteen years and was, when caught, a 'hagard' or mature bird. This is the first egg she has laid in captivity. It is very like a heron's egg and has a coarse shell, being without markings.

D. C. PHILLOTT."

FISH.

MELANIC SPECIMENS OF THE PUTIA (*Barbus ticto*).—The Putia is a small Cyprinine fish very common in ponds throughout India. The normal coloration is given by Day (*Faun. Ind., Fishes*, i, p. 325) as "silvery, sometimes stained with red, a black spot on the side of the tail before the base of the caudal fin and immediately behind the anal; a smaller one (frequently absent) at the commencement of the lateral line. Fins often black, sometimes orange." A number of specimens recently obtained from a tank at Rampur Bhoolia in the Rajshahi district of Eastern Bengal, show a varying tendency towards melanism. In some individuals this is barely perceptible, but in some the edges of the lateral and the whole of the ventral scales, the dorsal surface of the head and the fins (especially the pelvic, anal and dorsal) are more or less densely suffused with black. This is less noticeable in the region between the anal fin and the caudal spot, which is faintly ringed both in these and in normal specimens with cream-colour. The region below the caudal spot can be seen to be slightly paler than the rest of the body even in normal individuals, if they are examined alive; but its paleness is more striking in melanic examples. In none of those from Rajshahi can the anterior spot be distinguished; the fins of the paler individuals are almost colourless.

Day gives the number of horny rays in the dorsal fin as 8; it is just as frequently 7.

N. ANNANDALE.

CRUSTACEA.

TWO BARNACLES NEW TO INDIAN SEAS.—The following Cirripedes do not appear to have been recorded hitherto from the seas of India:—

Pœcilasma gracile, Hoek.

Several specimens from the spines of an Irregular Echinoid dredged by the Indian Marine Survey off the extreme south of India (Lat. 8° 37′ N., Long. 75° 37′ 30″ E.) from a depth of between 224 and 283 fathoms. The species was originally obtained by the 'Challenger' off Australia from a depth of 410 fathoms.

Pœcilasma eburneum, Hinds

Several specimens from the spines of an Echinoid of the family Cidaridæ, dredged by the Indian Marine Survey in the Persian Gulf from a depth of between 48 and 49 fathoms. The species was described from New Guinea. The specimens here recorded, as well as those of *P. gracile*, were attached to the spines surrounding the mouth of the Echinoid on which they occurred.

N. ANNANDALE.

INSECTS.

MOSQUITOES OF THE GENUS ANOPHELES FROM PORT CANNING, LOWER BENGAL.—At Port Canning, on account of the presence of many small accumulations of water in pools and ditches, the houses are infested with *Anopheles*: so much so that in December last I collected no less than 250 specimens within three hours in the rest-house alone. These specimens belonged to the following species :—

A. nigerrimus (the most abundant), *A. barbirostris*, *A. rossi*, *A. jamesi*, and a species which is probably new. The last may be described as follows :—

A small mosquito about the size of *A. jamesi*. *Palpi* with five nearly equal white bands ; the terminal band white, all distinct. *Proboscis* whitish, with a dark band near the middle. *Legs*—The femora and tibiæ of all the legs striped alternately with white and dark bands ; all the joints capped with white ; the remaining part of the legs, including the tarsi, dark. *Wings*—The costal vein with three large, dark bands and four small ones ; the first longitudinal vein with three large bands and two small ones ; the second with one band on the main trunk and two on the branches ; the third with three bands ; the fourth with four bands on the main trunk, three on the anterior and two on the posterior branch ; the sixth with three bands.

This species does not agree with any of the fifteen described in James and Liston's *Monograph of the Anopheles Mosquitoes of India*, being distinguished by the peculiar markings on the palpi, wings and legs. From the descriptions and figures in Theobald's *Monograph of the Culicidæ of the World*, so far as I can make them out, it seems very much like *A. punctulatus*, Dönitz, from the Malay Peninsula, but I cannot be sure of the identity.

G. C. CHATTERJEE.

ANOPHELES LARVÆ IN BRACKISH WATER.—James and Liston do not mention the occurrence of *Anopheles* larvæ in salt water in India, and recently several observers have suggested as a means of destruction of these larvæ that sea water might be admitted into pools containing them. But Mosquito larvæ have been found, though rarely, inhabiting salt water ; for example, Theobald (*Mon. Cul.*, i, p. 36) mentions that Dr. Bancroft found larvæ of *Culex marinus* in salt-water marshes in Australia. The brackish tanks at Port Canning, which also contain marine animals such as Medusæ and sea anemones, are full of *Anopheles* larvæ, which are found amongst filamentous algæ. On examination specimens proved, without exception, to be larvæ of *Anopheles rossi*. They were very abundant at the beginning of December, the water then containing 0·22 per cent. of soluble matter, but were much less so at the end of the same month. I noticed that when these larvæ were transferred to fresh water, they at once sank and crawled about the bottom of the vessel for some time. Then, by a series of muscular movements, they came to the surface. There was always a tendency for them to sink again ; whereas individuals from fresh water rise to the surface by their own buoyancy, not by muscular action, and do not remain at the bottom long if they sink. I obtained some larvæ from fresh water and placed them in water from the Port Canning pools: they died within a few hours.

G. C. CHATTERJEE.

MOSQUITOES FROM KUMAON.—Mosquitoes are very abundant in the lower parts of Kumaon at the end of September; during a visit to Bhim Tal (4,500 ft.) at that time of year the following species were collected: *Anopheles lindesayi* (Giles), *Toxorhynchites immisericors* (Walker), and *Stegomyia scutellaris* (Walker). (The last = *Culex albopictus*, Skuse.) All these were abundant, especially the first and the last. The *Anopheles* and the *Stegomyia* were breeding in water-butts by the side of European houses, and the latter also in cavities in jungle trees which had become full of rain-water.

N. ANNANDALE.

OLIGOCHÆTE WORMS.

PECULIAR HABIT OF AN EARTHWORM.—In the jungle at Bhim Tal I was surprised to find that hollows in trees which had become filled with dead leaves and rain-water, contained enormous numbers of small earthworms, all belonging to the same species. Dr. W. Michælsen, of Hamburg, has kindly examined specimens and says that they belong to the genus *Perionyx* and probably to the widely distributed species *P. excavatus*. All the specimens sent him proved to be immature, and although I made a careful search for individuals with the clitellum developed, I could not find any. The specific identification, therefore, is a little uncertain. The worms lay at the edge of the cavities, with the posterior half of the body sunk in the water and the anterior half closely applied to the wood; when touched they retreated among the dead leaves below the water. They occurred in large masses, which, owing to their bright coral-red colour and apparently filamentous structure, I mistook at first sight for fungi. I noticed that on a wet day the worms left the cavities and crawled about on the tree-trunks. Apparently they did so also at night, for I found many of them on the trunks early in the morning, while others were observed at this time of day crawling across paths and even roads. Those which were caught by the sun in such positions were killed, and almost every morning dead individuals, which apparently had perished because they had not reached a damp situation early enough, could be found on the exposed road surrounding the lake. I have noticed in the Malay Peninsula that certain species of Scorpion are subject to the same danger.

Together with the worm, I took in the tree-hollows numerous larvæ of the Mosquito *Stegomyia scutellaris* and of a beetle (probably an Elaterid), while I observed a handsome Tipulid, which Mr. E. Brunetti has identified as *Pselliophora chrysophila* (Walker), laying its eggs on the wood at the edge.

N. ANNANDALE.

VI. REVISION OF THE ORIENTAL *STRATIOMYIDÆ*, WITH *XYLOMYIA* AND ITS ALLIES.

ERRATUM.

Page 148, line 21. For "*indica*" read "*himalayanus*."

genera of the *Notacantha*, and he objected (to use his own words) to " the juxtaposition of *Subula* and *Xylophagus* in the same ultimate subdivision."

By structural characters, and by their metamorphoses, *Xylomyia* (*Subula* is preoccupied by Schummell in Mollusca, 1817) is much more related to the *Stratiomyidæ* than to *Xylophagus*, which latter genus is distinctly related to the *Leptidæ* and, in a less degree, to the *Tabanidæ* also.

In Aldrich's recent Catalogue of North American Diptera *Xylophagidæ*, as a family, is sunk bodily in *Leptidæ*, and *Cænomyia* with its allies added also. My own hesitation has been partly due to the costal vein in these genera being continued all round the edge of the wing, as in most other Brachycera, instead of terminating suddenly at the tip of the wing or just beyond it, which latter characteristic is peculiar to the *Stratiomyidæ*: also partly, to the variation from the typical venation, a character in which the *Stratiomyidæ* are strikingly consistent. Without expressing any definite opinion, having only casually studied the question of

VI. REVISION OF THE ORIENTAL *STRATIOMYIDÆ*, WITH *XYLOMYIA* AND ITS ALLIES.

By E. BRUNETTI.

CORRIGENDUM.

Change

Acanthina argentea mihi (preoccupied)

to

Acanthina argentihirta mihi.

genera of the *Notacantha*, and he objected (to use his own words) to " the juxtaposition of *Subula* and *Xylophagus* in the same ultimate subdivision."

By structural characters, and by their metamorphoses, *Xylomyia* (*Subula* is preoccupied by Schummell in Mollusca, 1817) is much more related to the *Stratiomyidæ* than to *Xylophagus*, which latter genus is distinctly related to the *Leptidæ* and, in a less degree, to the *Tabanidæ* also.

In Aldrich's recent Catalogue of North American Diptera *Xylophagidæ*, as a family, is sunk bodily in *Leptidæ*, and *Cænomyia* with its allies added also. My own hesitation has been partly due to the costal vein in these genera being continued all round the edge of the wing, as in most other Brachycera, instead of terminating suddenly at the tip of the wing or just beyond it, which latter characteristic is peculiar to the *Stratiomyidæ*: also partly, to the variation from the typical venation, a character in which the *Stratiomyidæ* are strikingly consistent. Without expressing any definite opinion, having only casually studied the question of

VI. REVISION OF THE ORIENTAL *STRATIOMYIDÆ*, WITH *XYLOMYIA* AND ITS ALLIES.

By E. BRUNETTI.

For some time I have been studying the *Stratiomyidæ* of the Oriental Region and the neighbouring parts of the Australian, partly for the purpose of revising the Indian Museum Collection in this group, and partly to enable me to identify my own captures during the last two years in India and other parts of the East, and the notes accumulated seem to be worth recording.

I intended including as *Stratiomyidæ* those genera which, under the older system of classification, would be placed in *Xylophagidæ*; but this would differ from the latest authorities, as in the elaborate new Catalogue of Palæarctic Diptera by Kertesz, Becker, Bezzi and Stein this latter group is still retained as a separate family. Some authors have disbanded it, relegating species of the *Xylomyia* (*Subula*) group to the *Stratiomyidæ*, and the remainder (*Xylophagus* group) to the *Leptidæ*, with which they undoubtedly have strong affinities. *Xylomyia* approximates to *Beris* in many respects. Baron Osten Sacken noted this in 1882 in his critical remarks on Dr. Brauer's paper on the characteristics of the genera of the *Notacantha*, and he objected (to use his own words) to "the juxtaposition of *Subula* and *Xylophagus* in the same ultimate subdivision."

By structural characters, and by their metamorphoses, *Xylomyia* (*Subula* is preoccupied by Schummell in Mollusca, 1817) is much more related to the *Stratiomyidæ* than to *Xylophagus*, which latter genus is distinctly related to the *Leptidæ* and, in a less degree, to the *Tabanidæ* also.

In Aldrich's recent Catalogue of North American Diptera *Xylophagidæ*, as a family, is sunk bodily in *Leptidæ*, and *Cænomyia* with its allies added also. My own hesitation has been partly due to the costal vein in these genera being continued all round the edge of the wing, as in most other Brachycera, instead of terminating suddenly at the tip of the wing or just beyond it, which latter characteristic is peculiar to the *Stratiomyidæ*: also partly, to the variation from the typical venation, a character in which the *Stratiomyidæ* are strikingly consistent. Without expressing any definite opinion, having only casually studied the question of

affinities, it seems to me that *Xylomyia* and its allies would be best placed with *Cœnomyidæ*, the family name of the latter retained, and the group placed next to the *Stratiomyidæ*, followed by the *Acanthomeridæ* as a family, followed again by the *Tabanidæ* and *Leptidæ* (including *Xylophagus* and its allies).

However, so far as this paper is concerned, I retain *Xylomyia* and the allied genera as a separate group.

The material in the Indian Museum in this family is not abundant in either species or specimens, and my own labours have only resulted in a limited number of both. For this reason it is to be regretted the more that a personal reference to Walker's types in the British Museum has been impossible, since about half the species in the family are his. Baron Osten Sacken's view to the effect that writings on the fauna of a region imperfectly known should be considered as preparatory and not final results seems correct, and his opinion that a writer is not "called upon to describe as new every specimen that he cannot identify" is echoed by my own. Therefore I am not sure whether analytical tables of genera and species should have been presented, for owing to my inability to obtain specimens of the majority of the species, the tables have had to be drawn up mainly from descriptions, and will be open to improvement on a better personal acquaintance with a larger proportion of the species.

GROUP XYLOMYINÆ.

Table of genera.

3rd and 4th externo-medial veins not united	*Xylomyia* Rond.
3rd and 4th externo-medial veins united just before the border of the wing.	
Thorax elongo-quadrate, discal cell 3 times as long as broad ..	*Rhachicerus* Wlk.
Thorax much longer than broad, discal cell 4 times as long as broad	*Rhyphomorpha* Wlk.

Xylomyia Rond., 1861.

Subula Mg., 1820; Sys. Besch., ii, 15.
(Preoccupied by Schummell in Mollusca, 1817.)
Solva Wlk., 1860, Proc. Linn. So., Lond., iv, 98.

Osten Sacken, in 1880, in his "Enumeration of the Diptera of the Malay Archipelago," says, "There is no necessity for a new genus *Solva* Wlk.; it is simply a *Subula* closely resembling in structure and colouring the European and North American species"; and as he has examined Walker's type in the British Museum, the identity may be held proved.

Table of species.

Posterior femora normal, not thickened.
  Legs without black markings.
    Abdomen luteous, with dorsal darker spots .. Long. 4 mm.[1] *flavipes* Dol.
    Abdomen cinereous black, testaceous at sides and on posterior borders each segment .. Long. $5\frac{1}{2}$—6 mm. *inamœna* Wlk.
  Legs with black markings.
    Abdomen uniformly blackish-brown .. Long. $3\frac{1}{2}$ mm. *vittata* Dol.
    Abdomen black with yellow testaceous marks.. Long. 10 mm. *calopodata* Big.
Posterior femora incrassated Long. 6—8 mm. *hybotoides* Wlk.

X. *flavipes* Dol., 1858.

(*Subula*) Nat. Tijd. Ned. Ind., xvii, 85.

Amboina. Closely allied to *inamœna* Wlk., for which Osten Sacken would have taken it, except for the brown antennæ of the latter. Having seen neither species, it appears to me that the difference in size and abdominal markings (though these latter are not so real as would appear on a first reading) would be a better means of separation.

Van der Wulp reports ♂ ♀ ♀ from New Guinea.

X. *inamœna* Wlk., 1860.

(*Solva*) Pr. Linn. So., iv, 98.

♀ Java, Celebes. Osten Sacken records two ♀ ♀ from Kandari (Celebes), taken in April 1874.

X. *vittata* Dol., 1858.

Nat. Tijd. Ned. Ind., xvii, 86.

♂ Amboina. 1 ♂. April.

X. *calopodata* Big., 1879.

Ann. So. Ent. Fr. (1879), 195.

♀ Ternate. Type in the Bigot Collection—now in the possession of Mr. Verrall, the English dipterologist.

X. *hybotoides* Wlk., 1862.

(*Solva*) Pr. Linn. So., vi, 5.

♂ ♀ Gilolo. The type of this species is said to be in the British Museum, but Osten Sacken did not find it there.

---

[1] All lengths given in this paper are in millimetres.

Rhachicerus Hal. in Wlk., 1848.

List Dipt. Brit. Mus., i, 124 (*nomen nudum*) and v, 103 (1854) description.

No description is given in the first reference, but a full description of the ♂ only is given in the second. I think, therefore, the date of the genus ought to be altered to 1854, but I have followed precedent in keeping it 1848. Only three oriental species are known; all closely allied.

Larger sp. Thorax and abdomen more reddish—wings more brownish, and cloud in wings much larger .. *fulviciornis* Sn. v. Voll.
Long. 12·13 mm. Thorax brownish yellow —wings with less brown .. .. *zonatus* O.S.

R. fulvicornis Sn. v. Voll., 1863.

(*Antidoxion* Versl. en Meded. Kon. Acad. v. Weten xv, 1, figs. 1—3. ♀ Java. Type in Leyden Museum.

Antidoxion of Voll. (1863) was recognised by Gerstaecke in the same year (Entom. Bericht, 1863, p. 410) as a synonym of *Rhachicerus* and Osten Sacken sees no justification in their separation. I have not seen a description of this species.

R. zonatus O. S., 1880.

Ann. Mus. Gen., xvi, 408.

♀ Mt. Singalang (Sumatra), July 1878. Long. (without ovipositor) 12·13 mm.

R. nigrinus Wandolleck, 1897.

Ent. Nach., xxiii, 290.

This species is described from Sumatra.

Rhyphomorpha, Wlk., 1861.

Pr. Linn. So., v, 275.
R. bilinea Wlk., 1861.
Pr. Linn. So., v, 275.

♀ Batjan. Long. 6 mm. The type should be in the British Museum, but Osten Sacken has not found it there.

FAMILY STRATIOMYIDÆ.

Table of sub-families.

A Abdomen of 7 segments .. *Berinæ.*
AA Abdomen of 5 or 6 segments.
B Discal cell, or this and the anterior basal cell together, emitting 3 veins. Abdomen short, often shorter than thorax and nearly always much wider .. *Pachygastrinæ.*

BB Discal cell, or this and the anterior basal cell together, emitting 4 veins. Abdomen nearly always much longer than thorax and generally only slightly wider. When much broader, abdomen quadrate (*Stratiomyinæ* only).

C Abdomen linear, oval or elliptical, not quadrate, antennæ of various forms.

D Antennæ always setiform, scutellum unspined, species nearly always of bright metallic colour .. .. *Sarginæ.*

DD Antennæ mostly stylate rarely setiform (*e.g.*, in *Oxycera*, etc.) Scutellum spined or not. Species rarely metallic.

E Abdomen oval, sometimes very short, often broader than thorax .. *Clitellarinæ.*

EE Abdomen elongate and always longer than thorax—barely wider .. *Hermetilnæ.*

CC Abdomen always approximately or nearly quadrate. Antennæ of three distinct joints, cylindrical .. *Stratiomyinæ.*

SUB-FAMILY I.—BERINÆ.

There is only one oriental species of this sub-family, namely *Beris javana*, V. d. Wulp, 1892, Dipt. Mid. Sumatra, 13. The author mentioned a ♀ as that of the *Beris javana* described by Macquart in Dipt. Exot., i, pt. 2, 188 ; but Osten Sacken having seen the type in the Paris Museum wrote to Van der Wulp, saying that the species was " *either an Evaza or a Tinda, at any rate not a Beris* ; *Beris javana* V. d. Wulp *must be a different species.*" The name therefore stands good for Van der Wulp's ♀ from Sumatra (taken at Rawas), it being impossible for the latter entomologist to mistake a *Beris* for a species of any other sub-family.

SUB-FAMILY II.—PACHYGASTRINÆ.

Table of genera.

A Antennæ sprayed .. .. *Ptilocera* Wied.

AA Antennæ of various forms, but not sprayed.

B Body elongate, nearly linear ; abdomen not much broader than thorax.

C Scutellum 4-spined.

D Antennal style narrow, not distinctly plumose. Scutellar spines small, of equal length. Small transverse vein absent .. .. .. *Tinda* Wlk.

DD Antennal style long, feathered, distinctly plumose on both sides. Inner

pair of scutellar spines much longer than outer. Small transverse vein present .. .. *Rosapha* Wlk.
CC Scutellum unspined.
E Posterior femora elongated, thickened, with spines below at tip .. *Enoplomyia* Big.
EE Posterior femora not thickened, nor elongated.
F Antennæ long and linear, thin.
G Abdomen distinctly longer than thorax .. .. .. *Salduba* Wlk.
GG Abdomen short and round .. *Acraspidea* Brauer.
FF Antennæ very short, 3rd joint round .. *Adraga* Wlk.
BB Body short, transverse. Abdomen generally much broader than thorax.
H Scutellum 4-spined.
I Abdomen only slightly longer or slightly shorter than thorax; scutellum normal.
J Last antennal joint leaf-shaped .. *Phyllophora* Mcq.
JJ Last antennal joint not leaf-shaped.
K Abdomen rather flat, elliptical, nearly bare, little longer but hardly broader than thorax .. .. *Evaza* Wlk.
KK Abdomen thick, nearly round.
L 3rd antennal joint round .. *Culcua* Wlk.
LL 3rd antennal joint cylindrical .. *Acanthina* Wied.
II Abdomen only about half the length of thorax. Scutellum large, with marginal suture .. .. *Obrapa* Wlk.
HH Scutellum with 2 short spines .. *Wallacea* Dol.
HHH Scutellum unspined .. .. *Pachygaster* Meig.

Ptilocera Wied., 1830.

Ausser. Zwiefl., ii, 58.

Table of species.

Thorax with well-defined bright green stripes.
4 stripes; wings brownish with abbreviated testaceous fascia .. Long. 7 mm. *fastuosa* Gerst.
2 stripes; wings nearly clear. Long. 10 mm. *smaragdifera* Wlk.
Thorax without well-defined stripes.
Thorax with gold pubescence in front and at sides .. Long. 8 mm. *quadridentata* F.
Thorax without such gold pubescence
Antennæ (presumably) all black
Long. 8 mm. *smaragdina* Wlk.
Antennæ with the tip white .. Long. 7 mm. *continua* Wlk.

N.B.—From the description of *amethystina* Sn. v. Voll. I can find no characters to separate it from *fastuosa* Gerst., so cannot include it in above table.

Pt. quadridentata Fab., 1805.

Sys. Antl., 86.

Fabricius describes the ♀ only.

In his Ausser. Zweifl., ii, 59, Wiedemann gives a better and longer description of both sexes. This species is generally distributed in the East: Malacca, Singapore, Amboina, Sumatra, Philippine and Aru Islands, Djokjokarta (Java), Makessar (Celebes), Papua.

Pt. fastuosa Gerst., 1857.

Linn. Entom., xi, 332.

(*smaragdina* Sn. v. Voll.)

Gerstaecker described it from a ♀ from Ceylon. Schiner records 3 ♂ ♂ from Tellschong (Nicobar Islands) which agree well with the species, and Meijere received 2 ♀ ♀ from Mañokwari (Papua) taken at the end of May.

Pt. smaragdifera Wlk., 1859.

Pr. Linn. So., iv, 94.

Makessar (Celebes), Philippine Islands.

Pt. continua Wlk., 1851.

Ins. Saunds. Dipt., II, 84, pl. iii, 2.

♀ Java. Two ♀ ♀ named by Bigot, from the Andaman Islands are included in the Indian Museum Collection.

Pt. smaragdina Wlk., 1849.

List Dip. Br. Mus., iii, 525.

Ceylon, Celebes, Philippine Islands. Osten Sacken examined a series of 30 from Celebes, 3 from Ternate, 3 from Papua and 1 from Amboina, thinking *Pt. amethystina* Sn. v. Voll. the same species; he added, "In 2 ♀ ♀ from Amboina and Papua, the greater part of the anal cell, and a portion of the 4th posterior are almost hyaline, while the interval between the anal cell and the costal margin is much darker brown than the distal half of the wing."

Pt. amethystina Sn. v. Voll., 1858.

Tijd. v. Ent., i, 92.

Java, Celebes, Philippine Islands. Three of each sex from the Philippine Islands are referred by Osten Sacken to this species; which he thought hardly to be separated from *smaragdina* Sn. v.

Voll. This latter species is considered a synonym of *fastuosa* Gerst. by Van der Wulp in his recent Cat. Dip. S. Asia, and as he probably had material on which to form a definite opinion, I follow him both in the synonymy and also in admitting *amethystina* Sn. v. Voll. as a distinct species, but with an impression that the latter form is but *fastuosa* Gerst.

Tinda Wlk., 1860.

Pr. Linn. So., iv, 101.

Table of species.

Antennal style 3 times as long as rest of 3rd joint .. .. .. Long. 6 mm. *indica* Wlk.
Antennal style twice as long as rest of 3rd joint.
Scutellum with yellow posterior border Long. 6 mm. *acanthinoides* Jaen.
Scutellum black, legs reddish, posterior femora black marked .. Long. 6 mm. *recedens* Wlk.

T. indica Wlk., 1851.

(*Biastes indicus* Saunds. Dip., II, 81, pl. iii, 1 and 1*a*.)
(♀ *Tinda modifera*, Wlk., Pr. Linn So., iv, 101.)
(*Phyllophora bispinosa*, Thoms., Eugen Reise, 454.)

♂. Locality not given by Walker. Celebes, Manila. This, the first species described of those now included in *Tinda*, was described under *Biastes*, created by Walker for it, but *Biastes* being preoccupied in Hymenoptera, *Tinda* must stand. Osten Sacken in his "Enumeration, etc." speaks of 4 ♂ ♂ from Kandari (Celebes) taken in April 1874 and remarks that the scutellum ("even in the type specimen") has 4 and not 6 spines as Walker says; but Walker queried his assertion as to the number of spines in his genus *Tinda*. Regarding *Biastes* Walker plainly says, "armed with 4 short tawny teeth," and his excellent figure shews but 4. Osten Sacken, whilst not sinking the genus *Phyllophora* Mcq., suspects that Walker's *P. angusta* from Singapore may be a *Tinda*. I find 2 ♂ ♂ in the Indian Museum Collection from Calcutta and Margherita (Assam).

T. acanthinoides Jaen., 1868.

(*Elasma*) Neue Exot. Dipt., 15, pl. i, 3.

♀ Java. The author placed this genus (*Elasma*) between *Acanthina* and *Phyllophora*. Type in the Heyden Collection which, I believe, is now in the Frankfort Museum.

T. recedens Wlk., 1861.

Pr. Linn. So., v 233.

♂ Dorey (Papua).

Rosapha Wlk., 1860.

Pr. Linn. So., iv, 100.

Osten Sacken corrects the author's error in saying 2 instead of 4 spines to the scutellum, and Meijere's splendid coloured plate of *bimaculata* shews 4, the inner pair much the longer.

R. habilis Wlk., 1860.

Pr. Linn. So., iv, 100.

♂ ♀ Long. 7 mm., Makessar (Celebes). Osten Sacken reports a ♀ from Kandari (Celebes) dated April 1874, and observes that the extent of black in the abdomen varies, and that the black mark on the thorax is sometimes wanting.

R. bicolor Big., 1879.

(*Calochætis*) Ann. So. Ent. Fr. (1879), 189.

(*Calochætis*, misprinted *Calcochætis*) Big., Bull. So. Ent. Fr. (1879), p. lxxiv.
♀ Manila. Type in Bigot's Collection.

R. bimaculata Meij., 1904.

Bijd. Dierk., xviii, 96 ; pl. viii, 13, 14.

♂ Java. Long. 6 mm. Gunong Tji Salimar. W. Preanger (Java).

I should not be surprised to find that the three just mentioned represent but a single species. Walker describes both sexes, mentioning that the abdomen is clear tawny in the ♂ and with the centre blackish in ♀. Bigot says "centre of abdomen blackish" (a ♀) and Meijere differentiates his species from Bigot's by the clear, reddish yellow abdomen. His type is a ♂ and perhaps he had not seen Walker's description of sexual differences.

The three descriptions read surprisingly alike, and the only character I can find that may separate the species is that *bicolor* and *bimaculata* have the brownish cloud towards the tip of wings separated by a clear hyaline space from the dark stigma, which clear space is not mentioned in Walker's species.

Osten Sacken has specimens from the Philippines shewing the hyaline space referred to by Bigot. Walker speaks of an elongated black spot on the front of the thorax in *habilis*, which seems only another way of describing Bigot's species *bicolor*—"longitudinal band from anterior to middle of disc"; this black mark, Osten Sacken announces to be variable.

Should my surmise be correct, the wing marks would be the best means of separating the species, as follows :—

Wings with darker cloud around stigma extending towards tip. Stigma ferruginous brown. ♂ Abdomen unicolorous tawny : in ♀ centre of abdomen blackish .. .. *habilis* Wlk.

Wings with subapical brown cloud separated from the blackish stigma by a clear hyaline space. ♂ abdomen clear reddish yellow. ♀ dark in centre
(*Calochætis*) .. *bicolor* Big.
(Syn. *Rosapha bimaculata* Meij. ♂.)

Osten Sacken (in his "Enumeration") regards *bicolor* Big. as a doubtful synonym of *habilis*, and Meijere notices the resemblance of his species to Bigot's. I fear Meijere's distinctions of colour in the proboscis and the halteres is insufficient to build a species on in a variable group. This being so, it is a question of the two species above being distinct, unless all are the same species, in which case *habilis* stands.

Enoplomyia Big., 1878.

Ann. Ent. So. Fr. (5) VIII Bull., p. xxii.

E. cothurnata Big., 1878.

Bull. Ent. So. Fr. (1878), p. 44.

♀ Batjan. Long. 10 mm. Bigot Collection.

Adraga Wlk., 1859.

Pr. Linn. So., iii, 82.

A. univitta Wlk., 1859 ; *l.c.*, 82.

♂ Mysol, Aru. Islands. Long. 6 mm.

Salduba Wlk., 1859.

Pr. Linn. So., iii, 79.

Table of species.

A Moderate sized species, 6 to 11 mm. long.
B Scutellum unarmed, antennæ not placed on a protuberance. Thorax striped, abdomen linear.
C Abdomen nearly twice as long as thorax. Femora red, posterior femora incrassated .. Long. 6—9 mm. *singularis* Wlk.
CC Abdomen a little longer than thorax. Femora yellow, black or brown (reddish in *gradiens* only). Femora not incrassated.
1 Legs red or yellowish.
Abdomen normal, length of body 6—9 mm.
Thorax with 2 indistinct cinereous stripes. Legs mainly reddish .. Long. 6—8 mm. *gradiens* Wlk.
Thorax with 4 gilded tomentum stripes. Legs mainly luteous .. Long. 6—9 mm. *hilaris* Wlk.
Abdomen clavate. Length of body 11 mm. Thorax with 4 cinereous stripes, centre pair joined on scutellum. Legs mainly yellow .. Long. 11 mm. *areolaris* Wlk.

2. Legs mainly whitish. Thorax with 4 gilded tomentum stripes .. .. Long. 9 mm. *diphysoides* Wlk.
3. Legs all black, except white base of tarsi. Thorax with a cinereous stripe each side .. Long. 7 mm. *lugubris* Wlk.

BB Scutellum with 4 minute teeth. Antennæ placed on a protuberance. Thorax (presumably) all black. Abdomen fusiform .. .. Long. 6 mm. *scapularis* Wlk.

AA Small species 3 to 4 mm.

3rd antennal joint elliptical, anterior femora with black traces. Long. $3\frac{3}{4}$ mm. *signatipennis* V. Wulp.

3rd antennal joint round, legs all pale yellow. Long. 3 mm. *exigua* V. Wulp.

This genus was placed by Walker in the subfamily *Sarginæ* and puzzled me for a long time, the nearly uniform black colour of all the species being such a contrast to the usual brilliant metallic colours in this group. Not being able to obtain a specimen, I was about to leave it where it was, when I obtained Van der Wulp's paper on New Guinea Diptera, in which he not only describes two new species (which may both be removed later owing to formation of the antennæ) but gives a diagram of the wing of *Salduba* shewing only three veins issuing from the discal and basal cells combined, thus placing it at once in the *Pachygastrinæ*.[1] Walker made no mention of this venation, nor had I any information on the point. The species *S. melanaria* Wlk., formed by Van der Wulp into a new genus *Cœnocephalus*, has 4 veins instead of 3 and therefore cannot be placed in *Pachygastrinæ*. This new genus seems by its linear abdomen and form of antennæ to approach nearest to the *Hermetiinæ*, where I bring it for the present.

Three other species of the restricted *Salduba* shew aberrant forms of abdomen—*scapularis* with fusiform abdomen and 4 minute teeth on the scutellum; while *singularis* with incrassated posterior femora minutely spined below, and the abdomen double the usual length may easily form the type of a new genus. *S. areolaris*, with its clavate abdomen, may also be regarded later as generically distinct.

S. singularis Wlk., 1861.

Pr. Linn. So., v, 271.

♂ ♂ Batjan. A ♂ is recorded from Ramoi (Papua). Osten Sacken thinks it differs from *gradiens* Wlk. only by less white at the base of the posterior tarsi and much more distinct spines on the hind femora. The incrassated posterior femora and abdomen of nearly double the usual length might entitle this species to generic separation.

[1] Van der Wulp also expressed his opinion of its affinity with *Tinda*.

S. gradiens Wlk., 1864.

Pr. Linn. So., vii, 203.

♀ Mysol. Type in British Museum Collection. Osten Sacken doubtfully refers to this species a single ♂ from Ramoi (Papua) taken February, 1875.

S. hilaris Wlk., 1861.

Pr. Linn. So., v, 271.

♂ ♀ Batjan. Has been queried as a var. of *diphysoides*.

S. areolaris Wlk., 1864.

Pr. Linn. So., vii, 204.

♂ Mysol. Allied to *hilaris* and *diphysoides*.

S. diphysoides Wlk., 1859.

Pr. Linn. So., iii, 79.

♂ Aru Islands.

S. lugubris Wlk., 1861.

Pr. Linn. So., v, 271.

Batjan.

S. scapularis Wlk., 1861; *l.c.*, 271.

♂ Batjan. It has been suggested that this may belong to Van der Wulp's new genus *Cænocephalus*, but this depends on its venation. Its fusiform abdomen and minutely spined scutellum might, however, entitle it to generic or subgeneric rank.

S. signatipennis V. d. Wulp, 1898.

Termés. Fuzet., xxi, 412, pl. xx, fig. 2 (head), fig. 2*a* (wing).

♂ ♀ Friedrich Wilhelmshafen (Papua).

S. exigua V. d. Wulp, 1898.

Loc. cit., 413; pl. xx, fig. 3 (head).

♂ One from Erima, Astrolabe Bay (Papua). The author rather doubts its right to a place in this genus, owing to the roundness of the 3rd antennal joint. This joint in *signatipennis* being elliptical instead of cylindrical forms a link between *exigua* and the other species and perhaps justifies them both remaining.

Acraspidea Brauer, 1882.

Denk. Kais. Acad. Wissens. Wien, xliv, 75.

A. felderi Brauer, 1882, *l.c.*, 75.

♂ Rambodde (Ceylon). Long. 5—6 mm.

Phyllophora Mcq., 1838.

Dip. Ex., i, pt. i, 178.

This generic name pre-occupied by Thunberg in Orthoptera.

P. angusta Wlk., 1857.

Pr. Linn. So., i, 7.

♂ Singapore. Long. 5 mm. This may be a *Tinda*, according to Osten Sacken.

Evaza Wlk., 1857.

Pr. Linn. So., i, 109.

(*Nerua*—sometimes misprinted *Nerna*—Wlk., 1858.)

Pr. Linn. So., ii, 81.

Most authors have been spelling this genus *Evasa*, but Kertesz in his recent monograph of the genus in Ann. Mus. Hong., vol. iv, 276, reverts to the original form. He alludes also to a closely allied genus of Walker's, *Artemita*, from S. America, differentiated from *Evaza* by having pubescent eyes.

Table of species.

- Legs principally blackish brown (anterior femora blackish brown, with more or less pale tips).
  - Scutellum with yellowish border Long. 8—8½ mm. *argyroceps* Big.
  - Scutellum all black, spines only yellowish .. Long. 5½—7 mm. *impendens* Wlk.
- Legs principally yellow (anterior femora yellow or yellowish brown).
  - Legs all yellow.
    - Scutellum black, with yellow spines, dorsum of thorax and scutellum distinctly arched, with yellow hair .. .. Long. 7 mm. *flavipes* Big.
    - Scutellum with posterior border partly black, dorsum of thorax and scutellum flat, with yellowish white hair .. Long. 7 mm. *bipars* Wlk.
  - Legs not all yellow.
    - Wing tips clear, all tibiæ all black or blackish brown .. Long. 9 mm. *tibialis* Wlk.
    - Wing tips not clear, tibiæ not throughout unicolorous.
      - Abdomen reddish brown, partly blackish brown.
        - Wings hyaline, fore-border brown from

subcostal cell to apex .. Long. 5—6 mm. *mollis* O. Sack.
Wings very pale brown ; only subcostal cell brown .. Long. $5\frac{1}{2}$—$7\frac{1}{2}$ mm. *fulviventris* Big.
Abdomen principally black or blackish brown.
Tibiæ of middle and posterior legs brown or blackish brown at apical half .. Long. 9 mm. *fortis* Wlk.
Tibiæ of middle and posterior legs all yellow ..
Anterior radial cell clear .. Long. $6\frac{1}{2}$ mm. *indica* Kert.
Anterior radial cell brownish Long. 6 mm. *scenopinoides* Wlk.

E. argyroceps Big., 1879.

Ann. So. Ent. Fr. (1879), 219.

♀ Moluccas. Bigot Collection. The author describes the ♂ only, but Kertesz's description applies to both sexes, from 3 ♂♂ and a ♀ in the Bigot Collection.

E. impendens Wlk., 1860.

Pr. Linn. So., iv, 197.

♂ ♀ Makessar (Celebes), Aru Islands. Osten Sacken mentions 9 ♂♂ 1 ♀ from Kandari (Celebes), April, 1874.

E. flavipes Big., 1879.

Ann. So. Ent. Fr. (1879), 219.

♀ India. Bigot Collection (badly preserved). Van der Wulp gives a ♂ from Friedrich Wilhelmshafen (Papua).

E. bipars Wlk., 1857.

Pr. Linn. So., i, 110 ; pl. vi, 2.

(*E. flavipes* V. d. Wulp, Términes. Fuzet., xxi, 416, nec *flavipes* Big. (Ann.), 1879.)

♂ Sarawak (Borneo) ; Papua. Kertesz also records it and describes the ♀ from a New South Wales (badly preserved) specimen in the Hermann Collection.

E. tibialis Wlk., 1861.

(*Clitellaria*) Pr. Linn. So., i, 57.

♂ Manado (Celebes). In his Cat. Dipt. S. Asia, Van der Wulp mentioned that, having 4 spines to the scutellum, this species

" might require a generic separation," and Kertesz refers it now to *Evaza* with the support of Mr. E. E. Austen of the British Museum, who has examined the type.

E. mollis Os. Sacken, 1880.

(*Nerua*) Ann. Mus. Gen., xiv, 415.

♂ ♀ Sumatra ; Papua. The author differentiates his species from *fulviventris* Big. and *bipars* Wlk., to which it is allied.

E. fulviventris Big., 1879.

Ann. So. Ent. Fr. (1879), 220.

♂ Moluccas. Bigot Collection. Kertesz describes both sexes, recording it in the Hungarian National Museum from Papua, dated 14th July and 24th December.

E. fortis Wlk., 1865.

(*Sargus*) Pr. Linn. So., viii, 107.

E. pictipes Big., 1879, Ann. So. Ent. Fr. (1879), 221.

♂ Papua.

Kertesz, after Mr. E. E. Austen's corroboration from an examination of the type, places this species here, and sinks *pictipes* as a synonym.

The Hungarian Museum possesses specimens from Papuan localities (Bali, Mafor, Stephansort, Simbang, Erima, Sakelberg). Van der Wulp also records a ♀ from Erima, Astrolabe Bay, Papua, and Meijere mentions a ♂ from " Oberes Jamur Gebiet," dated August 6th.

E. indica Kert., 1906.

Ann. Mus. Hung., iv, 289.

♂ ♀ Bombay, taken by Mr. Biro, 3rd July 1902.

E. scenopinoides Wlk., 1859.

(*Nerua*) Pr. Linn. So., iii, 81.

(*E. pallipes* Big., 1879 ; Annales, 220.)

♀ Aru Islands, N. Ceram, Waigion, Gilolo, Dorey, Batjan, Papua.

The Hungarian Museum has it from Papua taken in April and September. Van der Wulp gives a ♂ from Friedrich Wilhelmshafen (Papua) and Osten Sacken mentions 1 ♂ 2 ♀ ♀ from Dorei Hum (Papua), February 1875, also from Andai (Papua).

Culcua Wlk., 1857.

Pr. Linn. So., i, 109.

C. simulans Wlk., 1857 ; *l.c.*, 109.

♂ Malacca, Sarawak.

A specimen in the Indian Museum Collection seems to form an undescribed species of this genus from Tennasserim.

Acanthina Wied., 1830.*

Ausser. Zweifl., ii, 50.

The two oriental species may be distinguished as follows :—

Thorax marked with a cross. Abdomen with a basal, and 2 posterior silvery hair spots .. *azurea* Gerst.
Thorax unmarked, but with bright gold hair in front. Abdomen unmarked .. .. *auricollis* Big.

A. azurea Gerst., 1875.

Linn. Entom., xi, 335.

(*Clitellaria obesa* Wlk.)

Long. 7 mm. ♂ Ceylon, Ceram, Dorey (Papua), Batjan, Philippine Islands, Ramai and Andai in Papua (4 ♂ ♂ taken February 1875) also June and August 1872. Osten Sacken records the species as *C. obesa* Wlk., adding " very like *azurea* Gerst.," but mentions differences. He again (Dipt. Phil. Is., 1882) expresses doubt as to the identity of this species with 3 specimens examined by him from those Islands collected by Dr. Carl Semper.

A. auricollis Big.

♂ Kohima (Assam), Sadiya (Assam). Long. 8 mm. Type in Indian Museum.

I can find no reference to the description of this species, which appears distinct from *azurea* Gerst.

Obrapa Wlk., 1859.

Pr. Linn. So., iii, 82.

Table of species.

Body black.
 Shining black ; body of normal width ; wings clear .. .. Long. 5 mm. *perilampoides* Wlk.
 Dull black ; body narrower ; wings with cloudy spot .. Long. 44 mm. *celyphoides* Wlk.
Body with shining silvery hair .. Long. 33 mm. *argentata* V. Wulp.

* See end of paper for *A. argentea*, sp. nov.

O. perilampoides Wlk., 1859 ; *l.c* , 82.

♀ Aru Islands, Batjan, Kaisaa, Mysol, Dorei.

O. celyphoides Wlk., 1859 ; *l.c.*, 83.

♀ Aru Islands, Batjan, Dorei. Walker adds further characters in the same journal, vol. v, 273, and separates it from *perilampoides* by the characters given above.

O. argentata V. d. Wulp, 1898.

Termés. Fuzet., xxi, 417 ; pl. xx, 5.

1 ♂ from Tamara Berlinhafen (Papua).

Wallacea Dol., 1858.

Nat. Tijd. Ned. Ind., xvii, 82.

W. argentea Dol., 1858 ; *l.c.*, 82.

Gabasa argentea Wlk., Pr. Linn. So., iii, 80.

Amboina, not rare in April.

In the Indian Museum are ♀ ♀ from Calcutta, taken 8.1.06 and 14.3.07—also a ♀ from Mergui (Lower Burma). On 21.3.07 I took in Calcutta what is no doubt the ♂ of this species and which I think has not previously been noted. It resembles the ♀ in every way except that the tibiæ are a little browner. The eyes are sub-contiguous immediately above the antennæ, diverging thence upwards to the vertex, which is wholly occupied by the ocelli. The antennal style instead of being thick is quite filamentous.

Pachygaster Meig., 1803.

Illig. Mag., ii, 266.

Table of species.

Legs mostly black, tips of tibiæ and the tarsi pale .. .. Long. 3 mm. *rufitarsis* Mcq.

Legs mostly yellowish or whitish.

1. Legs yellow, femora with apical ½ brown .. Long. 2½ mm. *limbipennis* V. d. Wulp.
2. Legs brownish yellow. Femora and anterior tibiæ blackish brown .. Long. 3 mm. *lativentris* V. d. Wulp.
3. Legs quite white, tarsi tips faintly blackish .. Long. 2—2½ mm. *albipes* mihi sp. nov.

P. rufitarsis Mcq., 1846.

Dip. Ex. Supp., i, 57 ; pl. vi, 3.

♂ Pondicherry. Macquart Collection (now in the Paris Museum).

P. limbipennis V. d. Wulp, 1898.

Termés. Fuzet., xxi, 417.

2 ♂ ♂ Friedrich Wilhelmshafen (Papua).

P. lativentris V. d. Wulp, 1898; *l.c.*, 416.

1 ♀ Seleo, Berlinhafen (Papua).

P. albipes mihi sp. nov.

♀ Calcutta. Head and front shining black, a brilliant white streak each side of lower part of head. Antennæ and proboscis pale yellow. Thorax and abdomen shining black with short, sparse, silvery-grey hair, which is a little thicker and mixed with gold hairs on dorsum of thorax. Belly uniformly black. Legs uniformly dirty white, the tarsi tips faintly blackish. Wings quite clear, veins on foreborder pale yellowish. Halteres white. Described from 4 ♀ ♀ in the Indian Museum taken in Calcutta. Long. 2—2½ mm.

SUB-FAMILY III.—SARGINÆ.

Eyes in male not contiguous, approximate only, leaving a very narrow frontal space from vertex to antennæ.

Table of genera.

Antennal arista apical .. .. *Chrysochlora* Latr.
Antennal arista dorsal.
 2nd antennal joint projecting over base of 3rd on inner side. Species non-metallic, generally more or less yellowish .. .. .. *Ptecticus* Loew.
 2nd antennal joint not projecting over 3rd. Species nearly always bright metallic blue or green .. .. *Sargus* Fab.
Eyes in male absolutely contiguous.
 Eyes pubescent in both sexes .. *Chloromyia* Dunc.
 Eyes quite or practically bare in both sexes.
  3rd antennal joint 6-ringed .. *Brachycara* Thoms.
  3rd antennal joint 4-ringed .. *Microchrysa* Loew.

Salduba, hitherto placed amongst the *Sarginæ*, I relegated to the *Pachygastrinæ* immediately I saw a figure of the wings; supported by Van der Wulp's authority for its affinity with *Tinda*.

Microchrysa Loew, 1855.

Verh. Zool. Botan., v, 146.

Table of species.

Abdomen honey yellow.
 Long. 5 mm. Post. fem. ringed *flaviventris* Wied. ♂
 ,, 3 ,, Post. fem. pale. *bipars* Wlk.

Abdomen metallic ; never yellow.
  Abdomen unicolorous.
    Middle femora and tibiæ all pale
      Abdomen bluish violet .. *flaviventris* Wied. ♀
      Abdomen blackish, with purple reflections .. Long. 4 mm. *affinis* Wied.
    Middle femora and tibiæ indistinctly brown-ringed .. Long. 3 mm. *gemma* Big.
  Abdomen violet ; edges distinctly pale yellow .. Long. $2\frac{2}{3}$ mm. *calopus* Big.

M. flaviventris Wied.

(*Sargus*) Analec. Entom., 31, ♀.

(*annulipes* Thoms., Eugenie Reise, 461.)

♂ East India. Type in Royal Museum, Copenhagen.

Osten Sacken records a ♂ from Java, and I took one ♂ at Bareilly, 1st September 1905, and if I have determined the ♀ rightly I have taken 3 specimens, respectively at Mussoorie, June 26 ; Meerut, July (13 to 19) ; and Lucknow, August 8 ; all during 1905. From Papua Van der Wulp records 2 ♂ ♂ 1 ♀.

M. bipars Wlk., 1861.

(*Chrysomyia*) Pr. Linn. So., v, 273.

♂ Batjan. Walker says allied to *Sargus redhibens*, but I fail to see where.

M. affinis Weid.

(*Sargus*) Analec. Entom., 31.

♀ East India. Types in Copenhagen Museum and Wiedemann's Collection. Wiedemann (Auss. Zweif., ii, 41) suspects that this is the ♀ of *flaviventris*, and I am inclined to think so to.

M. gemma Big., 1879.

Ann. So. Ent. Fr. (1879), 231.

♀ Ceylon. Bigot Collection. Bigot emphasizes the very broad front in this species, and speaks of the middle femora and tibiæ being indistinctly brown-ringed, yet I would not be surprised to find it only the ♀ of *flaviventris* Wied.

M. calopus Big.

1 ♀ Margherita (Assam). I cannot trace the reference. (Incidentally I may add that Bigot described a *Chrysonotus calopus* ♀ in 1879 from Natal, but this is a different species.) Type in Indian Museum Collection. It is certainly a very distinct species.

In addition to the species mentioned I possess 3 specimens taken by myself at Mussoorie from June 18 to 26, 1905, in which the last antennal joint is entirely and quite black, the species otherwise agreeing with *flaviventris*. All the other species have entirely yellow antennæ, so I believe them to be new, but refrain from describing them as such until I obtain a more extended experience of the Eastern species.

Brachycara Thoms., 1868.

Eugenie Freg. Reise, 460.

B. ventralis Thoms., 1868; *l.c.*, 641, pl. ix, 4.

"Isl. Rossi." Van der Wulp infers he means an isle of this name in the Andamans. Ross Island is the one on which Port Blair, the seat of government in the islands, is situated. Both sexes are recorded by Van der Wulp from Seleo, Berlinhafen (Papua).

Chloromyia Dunc., 1837.

Mag. Zool. Bot.

The only two oriental species are easily separated.

Legs blue, with shining hoary hair Long. 8 mm. *sapphirina* Wlk.
Legs pale yellow, apical half of anterior legs black .. .. Long. 8 mm. *stigmatica* V. d. Wulp.

C. stigmatica V. d. Wulp, 1898.

Termés. Fuzet., xxi, 411.

2 ♀ ♀ from Friedrich Wilhelmshafen (Papua).

C. sapphirina Wlk., 1849.

(*Chrysomyia*) List Dip. Brit. Museum, iii, 519.

♀ East Indies. British Museum Collection.

Sargus Fab., 1798.

Ent. Sys. Supp., 566.

Table of species.

A Large species 14 to 18 mm. long.
B Abdomen rusty red, with dorsal blackish stripe; wings nearly clear .. Long. 14 mm. *rufus* Dol.
BB Abdomen metallic—no stripe, wings rather deeply blackish
1. Front piceous, legs tawny, streaked with pitch. Thorax blue-green, abdomen brilliant violet .. .. Long. 18 mm. *gemmifer* Wlk.
2. Front chalybeate, supra-antennal triangle pale green. Thorax blue-green, abdomen metallic violet, stigma testaceous .. .. Long. 15 mm. *pubescens* V.W.

3. Front brilliant, metallic blue-green, triangle yellow, stigma unicolorous, thorax blue-green, abdomen copper, violet reflections .. Long. 14 mm. *magnificus* Big.

AA Moderate sized species 7 to 10 mm. (*lætus* 12 mm.).

C Wings very long, each 14 mm. long Long. 12 mm. *longipennis* Wied.

CC Wings normal.

D Abdomen metallic blue-green, or thereabouts. Base not whitish; legs normally long.

E Legs all yellow (reddish yellow or yellowish white), no black in them: at most, tarsi tips darker or blackish.

F Stigma dark brown.

G Wing cinereous; whitish species. Disc of thorax and scutellum tip purple Long. 10 mm. *inactus* Wlk.

GG Wing clear, posterior half a little grey. Thorax and scutellum brilliant gold-green. Abdomen brilliant metallic violet .. .. .. Long. 8 mm. *pallipes* Big.

FF Stigma pale yellow ♂ eyes contiguous.

H ♂ eyes contiguous .. Long. 8—10 mm. *metallinus* F.

HH ♂ eyes not contiguous .. Long. 7—9 mm. *mandarinus* Sch.

EE Legs with distinct black rings, streaks, or more or less black.

1. Femora with black streak above, near tip .. .. Long. 7—8 mm. *redhibens* Wlk.
2. Base of posterior femora black and slender .. Long. 12 mm. *lætus* V. W.
3. Femora and tibiæ partly piceous .. Long. 9 mm. *concisus* Wlk.
4. Posterior half of posterior femora black .. Long. 9 mm. *albopilosus* Meij.
5. Anterior femora black at tip and posterior tarsi at base. Posterior femora and tibiæ black .. .. Long. 7 mm. *tibialis* Wlk.
6. Posterior tibiæ with blackish basal half Long. 9 mm. *mactans* Wlk.
7. Legs mostly brown marked, not black .. Long. (without head) 9 mm. *papuanus* Big.

DD Abdomen purple, white at base, legs extra long .. .. Long. 11 mm. *longipes* Wlk.

AAA Small species.

Long. 5 mm. black shining .. Long. 5 mm. *debilis* Wlk.

Long. 3 mm. pale tawny shining Long. 3 mm. *inficitus* Wlk.

S. rufus Dol., 1858.

Nat. Tijd. Ned. Ind., xvii, 83.

Amboina. Rare, during dry season.

S. gemmifer Wlk., 1849.

List Dip. Brit. Mus., iii, 516.

Sylhet. Type in British Museum.

S. pubescens V. der Wulp, 1885.

Notes Leyden Mus., vii, 67.

♀ Gorontolo.

S. magnificus Big., 1879.

Ann. So. Ent. Fr. (1879), 222.

Assam. Bigot Collection. Head and middle legs (except femora) missing from the type when described. In spite of this, I feel sure that 4 ♂ ♂ in the Indian Museum from Tenasserim are of this species.

The three species above must be closely allied, but from the descriptions appear to be truly distinct.

S. longipennis Wied., 1824.

Analec. Entom., 31.

♂ Java. Type in Westermann's Collection. Also recorded from Malacca; and a ♂ named thus by Bigot exists in the Indian Museum, labelled Sadiya (Assam).

S. inactus Wlk., 1860.

Pr. Linn. So., iv, 97.

♀ Makessar (Celebes).

S. pallipes Big., 1879.

Ann. So. Ent. Fr. (1879), 222.

♀ Ceylon. Type in Bigot's Collection.

S. metallinus F., 1805.

Sys. Antl., 258.

(*S. formicæformis* Dol., Nat. Tijd. Ned. Ind., xiv, 403; pl. iii, 5.)

The commonest of all *Stratiomyidæ* throughout the Orient and a widely distributed species. Walker reports it from Borneo, India, Java and the Aru Islands; the Indian Museum possesses specimens from Katmandu (Nepal), Calcutta, Siliguri, Dehra Dun and Naini Tal, the dates varying from June to August. It has, outside of India, a much wider range of appearance, as it has fallen to my net at Rangoon (January), Singapore (17th February 1906), Shanghai and Calcutta (both in May), Mussoorie (June), Meerut (July), and Lucknow (August and September).

S. mandarinus Sch., 1868.

Reise der Novara, 62.

♂ One example. Hong Kong, allied to the European *flavipes*. Schiner says the eyes quite touch, which may require it a generic separation, as in *Sargus* the eyes are approximate, not contiguous.

S. redhibens Wlk., 1860.

Pr. Linn. So., iv, 97.

♀ Makessar (Celebes). He mentions a variety with green thorax and purple vertex, and thinks it may be a local variety of *metallinus* F., but as he mentions dark markings on its hind legs, it could hardly be *metallinus*. I took one ♂ at Rangoon between 23rd December 1904 and 3rd January 1905, also a ♀ at Singapore, 17th February 1906, both certainly this species; but the posterior tibiæ have a black streak at the *base* and not at the tip.

S. lætus V. der Wulp, 1885.

Notes Leyden Mus., vii, 66.

♂ Sumatra. The author notes it near *mactans* Wlk., and would have considered it the male of that species but for the pattern and coloration of the abdomen.

S. concisus Wlk., 1861.

Pr. Linn. So., v, 273.

♂ Batjan, near *redhibens* Wlk.

S. albopilosus Meij.

Nova Guinea Res. L'Exp. Sci. Neerl. N. Guinea, Dipt., 73.
♂ Mañokwari (Papua).

S. tibialis Wlk., 1861.

Pr. Linn. So., v, 273.

♂ Batjan, Gilolo. Near *redhibens* Wlk.

S. mactans Wlk., 1860.

Pr. Linn. So., iv, 97.

♂ Makessar (Celebes), Amboina, Borneo, Ceylon. Osten Sacken saw three from Kandari (Celebes) taken April 1874, and one from Ternate, and pertinently adds: "There may be several conflicting species here, or else they vary in the extent of black on the legs, and in the colour of the stigma."

I think it probable that several of the species in this group may prove varieties, but described as most of them are, from single specimens, and these types not being available for examination in India, I cannot further our knowledge of the group.

Three ♂ ♂ in the Indian Museum Collection from Nepal (4,500 feet) taken in October, agree pretty closely with Walker's description, as does a ♂ in the same collection captured by Dr. Annandale at Bhim Tal, 19th to 22nd September 1906, also at an altitude of 4,500 feet. From this height to the plains and so low a latitude as Singapore and the East India Islands would be by no means an excessive range for a Dipteron.

Van der Wulp mentions 2 ♂ ♂ from Papua.

S. papuanus Big., 1879.

Ann. Soc. Ent Fr. (1879), 223.

♀ Bigot Collection.

S. longipes Wlk., 1861.

Pr. Linn. So., v, 232.

♂ Dorey (Papua). A male from Erima (Astrolabe Bay) Papua, is recorded by Van der Wulp.

S. debilis Wlk., 1861 ; *l.c.*, v, 274.

♂ Batjan. Near *redhibens* Wlk.

S. inficitus Wlk., 1861 ; *l.c.*, v, 274.

♂ Batjan.

Ptecticus Loew., 1855.

Verh. Zool. Bot., v, 142.

Table of species.

A Black species ; wings blackish (slightly tawny in front in *tenebrifer*).
Long. 18 mm. .. .. *remeans* Wlk.
,, 14 mm. .. .. *illucens* Sch.
,, 10 to 12 mm. .. .. *tenebrifer* Wlk.
AA Yellow species (sometimes much marked with black).
B Wing with basal half yellow tawny, remainder blackish or grey.
Posterior femora black .. Long. about 15-16 mm. *rufescens* V. d. Wulp.
Posterior femora reddish yellow.
1. Disc of thorax ferruginous, 3 indistinct darker lines. Abdomen with shining black dorsal bands. Posterior tibiæ in ♂ with brown band .. .. Long. 14-15 mm. *aurifer* Wlk.
2. Male genitalia black. 4th abdominal segment with a very large brown spot. 5th all blackish. Thorax all tawny, unmarked. Long. 15 mm. *apicalis* Lw.

3. ♂ genitalia black. 2nd to 6th abdominal segments, with broad black cross bands reaching the side border. Posterior tibiæ blackish brown .. .. Long. 16 mm. *cingulatus* Lw.
4. ♂ genitalia black; disc of thorax ferruginous. Body reddish yellow. Last abdominal segment black. Apical half of posterior tibiæ brown .. Long. 12-14 mm. *leoninus* Rond.
5. ♂ genitalia fulvous, very large and complex. Long. 15-16 mm. *Wulpii V. d. W.* nom. nov.

BB Wings with distinct black or blackish parts :—not yellow.
Long. 18 mm.
Abdomen all testaceous .. 18 *repensans* Wlk.
Abdominal last 2 segments black 18 *tricolor* Meij.
Long. 8 to 12 mm.
All tibiæ and tarsi blackish, abdomen subclavate, lengthened .. 8 *quadrifasciatus* Wlk.
Only posterior tibiæ black marked. Abdomen normal.
1. Posterior tibiæ and tarsi all black. Abdomen with a brown spot on segments 2 to 5.. 10 *rogans* Wlk.
2. Posterior tibiæ black, tawny marked apically. Abdomen with 4 broad, abbreviated piceous bands .. 12 *complens* Wlk.
3. Posterior tibiæ black, posterior tarsi whitish. Thorax indistinctly striped. Abdomen with abbreviated dilated black band on each segment .. .. 12 *tarsalis* Wlk.

BBB Wings nearly or quite clear, or pale grey. (Anterior margin yellowish in *ferrugineus* Dol.)
Anterior margin of wing yellow.. Long. 10 mm. *ferrugineus* Dol.
Anterior margin of wing not yellow.
Thorax with 3 stripes, species partly black .. .. Long. 11-12 mm. *brevipennis* R.
Thorax unstriped, species mostly yellow.
Abdomen black above with narrow lighter bands.. Long. 8 mm. *australis* Sch.
Abdomen tawny with broad black bands.
Posterior femora striped with black .. Long. 10 mm. *latifascia* Wlk.
Posterior femora testaceous tawny .. Long. 10 mm. *doleschalli* Big.

Pt. remeans Wlk., 1860.

(*Sargus*) Pr. Linn. So., iv, 96.

♀ Makessar (Celebes) ♀ "allied to *S. tenebrifer*" Walker says. Head wanting in the type. Osten Sacken notes 14 ♂ ♂ and 1 ♀ from

Kandari (Celebes) taken April 1874, but is hardly positive as to identity. Walker describes a perfect specimen of what he takes to be the male, but selects the headless female as the type!

Pt. illucens Sch., 1868.

Reise Novara, 65.

One example; sex? Hong Kong. A large handsome species, I took a ♂ ♀ *in cop.* and a separate ♀ at Yokohama, 21st to 26th May 1906, thus fixing the sexes and species. Schiner queried the sex of his type specimen. I think it was a ♂, because he mentions "front broad behind" and this is *apparently* the case (but not really so, proportionately) in this sex, owing to the eyes almost touching in front just above the frontal raised triangle. The front in the ♀ is slightly but distinctly wider. In the ♀ taken *in cop.*, the white 2nd translucent abdominal segment is much obscured. Van der Wulp mentions the occurrence of the species in Japan, from which land it also figures in the recent Catalogue of Palæarctic Diptera.

Pt. tenebrifer Wlk., 1849.

(*Sargus*) List Dip. Brit. Mus., iii, 517.

♀ China. Brit. Mus. Coll.

Pt. rufescens V. d. Wulp, 1868.

(*Sargus*) Tijd. Ent., xi, 104; pl. iii, 7 to 9.

By Van der Wulp's remark referring to his *apicalis* "close to *rufescens* V. W." I have presumed this species to be of the same size, and therefore enter it in my table as 15 to 16 mm.

Pt. aurifer Wlk., 1854.

(*Sargus*) List Dip. Brit. Mus., v, 96.

♂ ♀ India. N. China. Walker compares it to *S. cuprarius* L., differing from that species in venation.

Pt. apicalis Lw., 1855.

Verh. Zool. Bot., v, 142; pl. x, 3—4.

(*Sargus luridus* Wlk.; Pr. Linn. So., i, 8.)

♂ Pulo Penang. Type in Westermann's Coll.

There are six more or less closely allied species in this group, and I have had some difficulty in understanding them All seem distinguished from all other species in the genus by the basal half of the wing being brightly yellow, and the remaining half blackish—commencing at or just beyond the discal cell to the tip of the wing. Two species (*aurifer* Wlk., and *leoninus* R.) are said to have the disc of the thorax ferruginous, that is, darker than the general reddish yellow colour of the whole body—the former bearing, in addition, traces of three longitudinal lines. In *apicalis* Lw., the spot on the 4th abdominal segment is large, distinct and separate from the all black 5th segment. In a few specimens I captured in August 1895 at Mussoorie, which seem, almost undoubtedly, this species, I find faint traces of a blackish dorsal band on the 2nd and 3rd segments, and the posterior tibiæ are black at the tip and not at the base. A smaller specimen similarly marked, I refer to this species, although it answers fairly to *leoninus* Rond., except that the disc of the thorax is not darker, nor are the tarsi tips blackish. However, in size (12 mm.) and the apical black posterior tibiæ, it agrees with *leoninus* better than with *apicalis*.

Apicalis V. der Wulp (for which, *apicalis* being preoccupied by Loew, I take the liberty and pleasure in proposing the name of its illustrious author *Wulpii*) stands out from *apicalis* Lw., *cingulatus* Lw., and *leoninus* Rond., by its very prominent and complicated *fulvous* genitals, which are black in the other three species. In *cingulatus* the abdominal bands are broad, and transverse, extending to the border; in *aurifer* the band is *dorsal*; in *apicalis* Lw., the 4th segment is occupied by a large, black, oval, distinct spot, whilst in *leoninus* the whole last segment only of the abdomen is black—wherein it differs from *Wulpii*, which has the last two or three segments purplish brown. These various markings, if consistent would sufficiently separate the species—and in the only two species I recognise with certainty, from actual specimens, the consistency seems sufficiently present. These are the 4 or 5 *apicalis* Lw. in my own collection and 5 or 6 damaged *Wulpii* (one specimen named by Bigot) in the Indian Museum.

Pt. cingulatus Lw., 1855.

Verh. Zool. Bot., v, 143.

♂ Penang. Westermann's Coll.

Pt. leoninus Rond., 1875.

(*Sargus*) Ann. Mus. Gen., vii, 454.

♂ Locality not given.

Pt. wulpii nom. nov.

(*Pt. apicalis* V. d. Wulp nom bis lectum.)

Notes Leyden Mus., vii, 62, 1885.

♂ Sumatra, Borneo. Near *leoninus* Rond., but genitalia *fulvous*, conspicuous and complex instead of black.

The Indian Museum specimens (*vide* note on *Pt. apicalis* Lw.) are from Margherita (Upper Assam).

Pt. repensans Wlk., 1860.

(*Sargus*) Pr. Linn. So., iv, 96.

♂ Makessar (Celebes). Walker says, allied to *S. aurifer* Wlk. Osten Sacken in reporting 9 ♂ ♂ and a ♀ from Kandari (Celebes), April 1874, adds, "Walker should not have called the wing cinereous — otherwise, the description is recognisable."

Pt. tricolor Meij., 1904.

Bijd. Dierk., xviii, 95; pl. viii, 11.

1 ♂ Sukabumi (Java). The author adds "V. der Wulp descr." The coloured illustrations in this paper by Meijere are most excellent.

Pt. quadrifasciatus Wlk., 1861.

(*Sargus*) Pr. Linn. So., v, 146.

♂ Amboina, Batjan. The author adds further characters and a description of the ♀ in his article on Batjan Diptera. Osten Sacken records 1 ♂ from Dorei Hum (Papua), February 1875, and, suspecting variability in the black on the abdomen, places here also a ♀ from Ternate.

Pt. rogans Wlk., 1859.

(*Sargus*) Pr. Linn. So., iii, 81.

♀ Aru Isles. Type in British Museum much damaged. Osten Sacken saw a ♂ from Dorei Hum (Papua) marked February 1875 and adds that *ferrugineus* Dol. is near it, but has no brown spots on the abdomen, nor brown cloud at wing tip. *Pt. doleschalli* Big. from Mysol is probably this species. Osten Sacken has seen a specimen from the Philippines named by Walker as this species, I took a few ♀ ♀ at Lucknow, 7th September 1905, which agree, except that the posterior tarsi are yellow, not black, but in one ♂ they are blackish at the base.

Pt. complens Wlk., 1859.

(*Sargus*) Pr. Linn. So., iii, 81.

♀ Aru Isles.

Pt. tarsalis Wlk., 1861.

(*Sargus*) Pr. Linn. So., v, 274.

♀ Batjan, Gilolo.

Pt. ferrugineus Dol., 1858.

(*Sargus*) Nat. Tijd. Ned. Ind., xvii, 83.

Amboina. Rare during dry season. Van der Wulp records 5 ♀ ♀ from Papua allied to *rogans* Wlk., *rufus* Dol., and *latifascia* Wlk.

Pt. brevipennis Rond, 1875.

(*Sargus*) Ann. Mus. Gen., vii, 454.

Pt. australis Sch., 1868.

Reise Novara, 65.

One ♀ Fani Is. (Nicobars). In the Indian Museum 2 ♂ ♂ and 2 ♀ ♀ from Assam (Sadiya and Margherita) and also from Dehra Dun, the species determined by Bigot.

Pt. latifascia Wlk., 1857.

(*Sargus*) Pr. Linn. So., i, 110.

♂ Java, Sumatra.

Pt. doleschalli Big., 1879.

Ann. So. Ent. Fr. (1879), 231.

♂ Mysol. Bigot Coll. May be the same species as *rogans* Wlk., according to Osten Sacken in Ann. Mus. Genova, xvi, 416. Van der Wulp mentions 4 ♂ ♂ from Tamara and Berlinhafen (Papua).

Chrysochlora Latr., 1825.

Fam. Nat. du regne anim., 494.

The two species recorded from the East vary enormously in size, that of Doleschall being only 3 mm. in length, whilst *C. baccoides* is 17.

Ch. vitripennis Dol., 1856.

Nat. Tijd. Ned. Ind., x, 408 ; pl. xi, 2.

Djokjokarta (Java).

Ch. baccoides Rond., 1875.

Ann. Mus. Gen., vii, 454.

♀ Borneo.

SUB-FAMILY IV.—CLITELLARINÆ.

Table of genera.

A Thorax with a strong side spine.
  Antennal style thickly pilose .. *Negritomyia* Bg.
  Antennal style bare .. .. *Ephippiomyia* Latr.
AA Thorax with no side spine.
  Scutellum very gibbous, abdomen always shorter than thorax.
    Scutellum unspined.
      Abdomen little broader than long, much shorter than

thorax ; antennæ very short .. .. *Saruga* Wlk.
Abdomen much broader but not longer than thorax ; antennæ nearly as long as thorax .. .. *Aulana* Wlk.
Scutellum 2-spined .. .. *Musama* Wlk.
Scutellum normal, abdomen shorter or longer than thorax.
1. Scutellum bare.
Face produced into a snout .. *Nemotelus* Geoff.
Face not so produced.
Abdomen elliptical, elongated a little .. *Lasiopa* Brullé.
Abdomen globose, very much broader, and a little longer than thorax *Ruba* Wlk.
2. Scutellum with 2 spines.
Spines very distinct, abdomen short, round, very arched .. *Oxycera* Meig.
Spines often small or indistinct, abdomen elongated, less arched .. .. *Clitellaria* Meig.
3. Scutellum 4-spined .. .. *Trichochæta* Big.

Negritomyia Big., 1879.

Ann. So. Ent. Fr. (1879), 190.

The species are closely allied in markings, coloration and size ; and a rough table for their identification is all that can be drawn up in the absence of specimens of any of the species.

1. Femora black, base pale : large brown spot above discal cell. Long. 10 mm. *maculipennis* Macq.
2. Legs luteous ; wings cinereous—costa luteous .. .. Long. 12 mm. *festinans* Wlk.
3. Legs pale tawny testaceous ; wing brownish, base clearer .. Long. 11 mm. *albitarsis* Big.
4. Legs brown, base of femora pale, wing nearly clear, brown stigma, diffused band near tip, reddish spot on lower edge of wing Long. 9 mm. *consobrina* Big.

N. maculipennis Macq., 1851.

Dipt. Exot. Supp. 4, 54.

♂ ♀ Manila, Ternate, Papua, near *Clitellaria heminopla* Wied. Type in Paris Museum. In his "Enumeration" Osten Sacken records 1 ♂ and 4 ♀ ♀ from Ramoi and Dorei Hum (Papua) taken February 1875, and from Ternate; also 12 ♂ ♂ ♀ ♀ from Manila, the abdomen in these latter being more bluish than in the East Indian Islands specimens. Meijere announces a ♀ from Mañokwari (Papua), taken May 2nd. In 1880 Osten Sacken queried "*Odontomyia cinerea*" Dol. (=*Ephippiomyia* id) from Amboina as a synonym of this species, but Van der Wulp keeps them generically divided in his Catalogue.

N. festinans Wlk., 1860.

Pr. Linn. So., iv, 95.

(*Engonia aurata* Sch.)

♂ Makessar, Amboina. The author also adds what he considers the ♀. Osten Sacken records 3 ♂ ♂ 1 ♀ from Kandari, April 1874.

N. albitarsis Big., 1879.

Ann. So. Ent. Fr. (1879), 207.

♀ Papua. Bigot Coll. Also known from Australia.

N. consobrina Big., 1879; *l.c.*, 208.

♂ Papua. Bigot Coll.

Ephippiomyia Latr., 1809.

Gen. Crust. Ins., iv, 276.

Emended from *Ephippium* Latr. by Bezzi, 1902, Zeits. Hym. Dip., ii, 191.

Ephippium being preoccupied by Bolten in Mollusca 1798, the change of name is merely an emendation. I believe no change of generic characters attaches to Ephippiomyia, but I have not seen the work. I mention this because the new Palæarctic Catalogue attributes the genus to Bezzi, as though newly created.

Table of species.

Rather large sized species 10 to 14 mm.
  Femora black .. .. Long. 12-14 mm. *bilineatum* F.
  Femora livid, except towards tips Long. 10 mm. *responsale* Wlk.
Moderate sized species, 7 mm. ..
  Thorax with two stripes of gilded tomentum .. .. .. Long. 7 mm. *gavasum* Wlk.
  Thorax with two indistinct whitish stripes .. .. Long. 7 mm. *cinereum* Dol.
Quite small species .. .. Long. 4 mm. *nigerrimum* Dol.

E. bilineatum F., 1805.

(*Stratiomys*) Sys. Antl., 79.

Clitellaria bivittata Wied., Auss., ii, 46.
Ephippium augustum Macq., Dipt., i, 252.

Raphiocera spinithorax Macq., Dip. Ex. Sup., 3, 17; pl. i, 7.
Clitellaria tenebrica Wlk.; List Dip. Brit. Mus., vii, 522.
Ephippium spinigerum Dol., Nat. Tijd. Ned. Ind., x, 407.
Negritomyia bilineata V. d. Wulp, Notes Leyd. Mus., vii, 59.

Reported to be common in Java and to occur in Amboina. I did not come across it although collecting in Java in five localities. Also occurs in Japan.

Two specimens from Tenasserim are in the Indian Museum, of which one, with contiguous eyes, is certainly a ♂. The other has the eyes very slightly but distinctly apart. It is not a ♀, because in this genus the eyes in the ♀ should be widely apart, yet the specimen is undoubtedly of the same species as the first one.

Another specimen also from Tenasserim in the Indian Museum Collection varies in nothing but size, and is a fine *Ephippiomyia* with absolutely contiguous eyes, whilst an interesting fourth specimen (unfortunately minus its antennæ), likewise from Tenasserim, appears to belong to the same genus, but has no side spines. The abdomen is much wider than the thorax as in the typical European species *thoracica* Latr., whereas in *bilineata* it is ovately elongated, and this latter species does not strike one at first as an *Ephippiomyia* at all. Without thoracic spines (of which there is no trace whatever) the Tenasserim specimen becomes an *Oxycera*, but its size (7 mm.), general facies, and black colour approximates it more to the present genus. Regarding the species with linear abdomens not wider than the thorax, I think a separate genus should be established for them. This would include *bilineata* F., and *Ephippiomyia* would be reserved for species in which the abdomen is much broader than the thorax, also comparatively much shorter, thicker and more convex.

E. responsale Wlk., 1865.

(*Clitellaria*) Pr. Linn. So., viii, 106.

♂ Papua. Allied to *bivittata*, but with broader antennæ.

E. gavasum Wlk., 1860.

(*Clitellaria*) Pr. Linn. So. iv., 95.

♂ Makessar (Celebes). The author also describes what he thinks is the ♀.

E. cinereum Dol., 1857.

(*Clitellaria*) Nat. Tijd. Ned., xiv, 403.

Amboina. In Van der Wulp's Catalogue, he doubts if an *Ephippiomyia*, and questions the form of its antennæ.

E. nigerrimum Dol., 1858.

Nat. Tijd. Ned. Ind., xvii, 81.

Amboina. A mountain species taken in April, no sex mentioned.

Saruga Wlk., 1860.

Pr. Linn. So., iv, 101.

S. conifera Wlk., 1860 ; *l.c.*, 103.

♂ Makessar (Celebes).

Aulana Wlk., 1864.

Pr. Linn. So., vii, 204.

A. confirmata Wlk. ; *l.c.*, 204.

♀ Mysol.

Musama Wlk., 1864.

Pr. Linn. So., vii, 205.

M. paupera Wlk., 1864 ; *l.c.*, 205.

♀ Mysol. In Carl Semper's collection of Diptera from the Philippines, reported on by Osten Sacken in 1882, was a specimen identified as *paupera* by Walker himself, but Osten Sacken finds it disagrees with the description in several points.

Nemotelus Geoff., 1764.

Hist. d. Insects, ii, 542.

N. albiventris Thoms., 1868.

♂ Manila.

Lasiopa Brulle', 1832.

Exped. à Morée, iii, 307.

Table of species.

Moderate sized species	..	.. Long. 10 mm. *villosa* F., var. nov. *himalayensis* mihi.
Small species 4 to 6 mm.		
Antennæ tawny.		
Long. 6 mm. ..	..	.. *radians* Wlk.
,, 4 mm. ..	..	.. *detracta* Wlk.
Antennæ black	..	.. Long. 4 mm. *infera* Wlk.

L. villosa F., var. nov. *himalayensis* mihi.

At Mussoorie in May 1905 (12th and 31st) I took 3 ♀ ♀ which hardly differ from the typical form of this European species. The abdominal spots are slightly narrower and not quite curved upwards so much at the inner ends.

L. radians Wlk., 1857.

(*Cyclogaster*) Pr. Linn. So., i, 7.

♀ Singapore.

L. detracta Wlk., 1857.

(*Cyclogaster* id) *l.c.*, 108.

♀ Sarawak.

L. infera Wlk., 1857 ; *l.c.* 107.

♀ Sarawak.

Ruba Wlk., 1860.

Pr. Linn. So., iv, 100.

Walker gives his description of the ♀, but the only species mentioned is a ♂!

Body wholly testaceous ..	Long. 8 mm.	*inflata* Wlk.
Abdomen black, with whitish pubescence	Long. 6 mm.	*opponens* Wlk.

R. inflata Wlk., 1860.

Pr. Linn. So., iv, 101.

Dr. Brauer in Denks. Kais. Ac. Wiss. Wien., xliv, 77, thinks that Schiner's *Thylacosoma amboinense* from that island may be a synonym.

A specimen in the Indian Museum Collection from Kohima (Assam) agrees rather well with this species, but is rather larger (10 mm.) and shews abnormal expanse of wing (12 mm. from centre of thorax to tip of wing—the other wing is missing, also the antennæ). In other respects there are differences ; it may be a new species.

R. opponens Wlk., 1865.

Pr. Linn. So., viii, 107.

♂ Papua. Van der Wulp also records it from Friedrich Wilhelmshafen in Papua.

Oxycera Meig., 1803.

Illig. Mag., ii, 265.

O. manens Wlk., 1860.

Pr. Linn. So., iv, 96.

♂ ♀ Makessar (Celebes).

Oxycera indica mihi, sp. nov.

♀ N.W. India. Long. $4\frac{1}{2}$ mm. Head entirely lemon yellow, except a rather wide black band on the vertex reaching from eye to eye. Four small black spots arranged in the form of a square, all placed at an equal distance from the base of the antennæ, which latter are tawny brown, darker at the tip. Lower part of head yellow behind, a moderately wide yellow band encircling the head —passing behind the vertex. The whole head, including the eyes, sparsely pubescent with short pale yellow hairs. Proboscis prominent, black. Thorax aënus black above, with short, rather close yellowish white hair ; underside black. Sides lemon yellow from anterior corners of dorsum to beyond root of wings. Scutellum lemon yellow, base narrowly black ; two very small spines. Abdomen pale yellow, with very short yellowish white hairs and black marked as follows : a large diamond-shaped spot spread over the centre of the 1st and 2nd segments, a minute spot on each side of the base of the 2nd segment ; rather more than the basal half of 3rd, 4th and 5th segments black,—these bands being joined to one another in their centres and the upper one to the large diamond spot on 2nd segment. Belly yellow. Legs lemon yellow, pubescence yellow, minute ; a black ring on all the femora and the posterior tibiæ. Wings colourless, veins pale yellow on anterior portion. Halteres pale yellow.

Described from 2 ♀ ♀ in perfect condition in the Indian Museum Collection. Type from Bareilly, United Provinces (15th to 22nd March 1907); the second specimen from Rampur Chaka (23rd to 31st January 1907). In the type the upper pair of spots on the front are larger than the lower ones ; in the other example, all four are of uniform size. A larger specimen taken at Calcutta (June 22nd) has four complete black abdominal bands, the first being basal.

This species differs from *O. manens* Wlk. by the latter having the abdomen entirely black.

Clitellaria Meig., 1803.

Illig. Mag., ii, 265.

Table of species.

Antennæ black.
- Thorax with three green stripes .. Long. 5—7 mm. *flaviceps* Wlk.
- Thorax "with a band and stripe of grey tomentum" .. Long. 10 mm. *notabilis* Wlk.

Antennæ tawny red.
- Thorax with yellowish hairs on dorsum .. Long. 7 mm. *heminopla* Wied.
- Thorax with 3 interrupted downy bands .. Long. 8 mm. *varia* Wlk.

C. flaviceps Wlk., 1857.

Pr. Linn. So., i, 7.

♀ Singapore, Sarawak.

C. notabilis Wlk., 1857.

Pr. Linn. So., i, 108.

♀ Borneo.

C. heminopla Wied.

Zool. Mag., iii, 30.

♂ ♀ Tranquebar.

Not uncommon in India. I took several of each sex at Meerut, 25th April 1905; and odd specimens at Calcutta, 18th to 24th November 1905; Jhansi, 31st March 1905; Jullundur, 5th May 1905; and Lucknow, 7th September 1905. The Indian Museum possesses it from Karachi and Calcutta.

Two ♂ ♂ I took at Meerut, 13th to 19th July 1905, have the femora pale at the base.

C. varia Wlk., 1854.

List Dipt. Br. Mus., v, 63.

♂ Java, Sarawak, Malacca.

Trichochæta Big., 1879.

Bull. So. Ent. Fr., 26; Annales (1879), p. 190 (published first in pt. 3, p. 6, 1878).

T. nemoteloides Big., 1879; *l.c.*, 191.

♀ Ternate. Bigot Coll.

SUB-FAMILY V.—HERMETIINÆ.

Table of genera.

Scutellum unspined.
  Abdomen elongated, not linear.
    Head produced horizontally, antennæ long, almost filiform, horizontal .. .. .. *Cœnocephalus* V. d. Wulp.
    Head normally vertical.
      Antennæ apparently of 3 distinct joints, not of uniform width; last joint of 8 divisions .. .. *Hermetia* Latr.
      Antennæ apparently filiform, not of uniform width; last joint of at most 6 divisions. *Eudmeta* Wied.
  Abdomen linear, contracted at base .. *Massicyta* Wlk.

Scutellum 2-spined, antennæ filiform.
Discal cell elongated, and attenuated posteriorly .. .. .. *Ampsalis* Wlk.
Discal cell (presumably) normal.
Abdomen elongated, as wide as thorax .. .. *Campeprosopa* Macq.
Abdomen elongate-elliptical; attenuated at base, a little broader and longer than thorax .. *Tracana* Wlk.

Cænocephalus V. der Wulp, 1898.

Termés. Fuzet., xxi, 413.

Van der Wulp in separating *Salduba melanaria* Wlk., from the rest of the genus and creating the above genus for it, recognised at once that the venation placed this species in a different sub-family supplemented by a most unusual form of head. Moreover, he recognised *Salduba's* true position (*Pachygastrinæ* sub-family) by his remarks as to its affinities with *Tinda*.

C. melanarius Wlk., 1861.

(*Salduba*) Pr. Linn. So., v, 271.

♂ Batjan.

Hermetia Latr., 1805.

Hist. Nat. Crust. Ins., xiv, 238.

Table of species.

Scutellum unspined.
Legs all or mainly black or blackish brown.
Wings clear, tip a little darker, stigma black brown .. Long. 14 mm. *fenestrata* Meij.
Wings blackish.
Long. 10 to 12 mm.
Posterior borders of abdominal segment bright yellow. Long. 10-12 mm. *cerioides* Wlk.
Posterior borders of abdominal segments whitish. Long. $10\frac{1}{2}$ mm. *albitarsis* V. d. Wulp.
Long. 14 to 16 mm.
Thorax with 3 indistinct cinereous stripes Long. 14-16 mm. *remittens* Wlk.
Thorax with pale yellow marks .. Long. 14 mm. *laglaizei* Big.
Legs yellow or reddish
Wings blackish. Thorax with 3 indistinct gold stripes .. Long. 12 mm. *rufiventris* Wlk.

Wings clear. Thorax with 1 indistinct white line .. Long. 13 mm. *læta* Meij.
Scutellum 2-spined .. Long. 17-19 mm. *armata* V. d. Wulp.

H. fenestrata, Meij., 1904.

Bijd. Dierk., xviii, 93 ; pl. viii, 9.

1 ♂ Palembang.

H. cerioides Wlk., 1859.

(*Massicyta*) Pr. Linn. So., iii, 78.

H. *batjanensis* V. d. Wulp, 1885 ; Notes Leyd. Mus., vii, 67.

♀ Moluccas, Aru Isles, Gilolo, Batjan, South Halmaheira.

Walker described this under his genus *Massicyta*, distinguished from *Hermetia* by a subpetiolate abdomen and more elongated and linear body, but I agree with Van der Wulp in keeping it in *Hermetia*, a genus in which all degrees of slight contractions of the first abdominal segments occur. *Massicyta* must be reserved for distinctly subpetiolated species such as *bicolor* Wlk.

A series of ♀ ♀ exists in the Indian Museum Collection, but they bear no data. Van der Wulp had 2 ♀ ♀ from Seles, Astrolabe Bay (Papua).

H. albitarsis V. der Wulp, 1898.

Termés. Fuzet., xxi, 419.

♀ Friedrich Wilhelmshafen (Papua).

H. remittens Wlk., 1860.

Pr. Linn. So., iv, 94.

♀ Makessar (Celebes).

H. laglaizei Big., 1887.

Ann. So. Ent. Fr. (1887), 21.

♀ Amberbek (Papua). Type much damaged.

H. rufiventris Wlk., 1861.

Pr. Linn. So., v, 145.

♀ Amboina.

H. læta Meij., 1904.

Bijd. Dierk., xviii, 93 ; pl. viii, 8.

♀ Bengal, near *cerioides.* This is true, for, from the excellent plate I immediately recognised one ♀ which I had eliminated from the series of ♀ *cerioides* in the Indian Museum as distinct.

H. armata V. d. Wulp, 1885.

Notes Leyd. Mus., vii, 68.

♀ Morotai. In possessing two spines on the scutellum this species differs from all others in the genus, and, I think, entitles it to generic rank.

Massicyta Wlk., 1857.

Pr. Linn. So., i, 8.

There are only two oriental species, the former 12—14 mm. in length, the latter 22.

M. bicolor Wlk., 1857.

Pr. Linn. So., i, 8 ; pl. i, 1.

♀ Singapore. The plate given is excellent.

M. inflata Wlk., 1859.

Pr. Linn. So., iii, 78.

♀ Aru Isles.

Eudmeta Wied., 1830.

Ausser. Zweifl., ii, 43.

Table of species.

Large species .. .. Long. 14 mm. *brunnea* Meij.
Smaller species.
  Black species with green markings. Long. 9 mm. *marginata* F.
  Ferruginous luteous species .. Long. 7 mm. *flavida* Big.

E. brunnea Meij., 1904.

Bijd. Dierk., xviii, 94 ; pl. viii, 10.

♂ ♀ Darjeeling. One ♀ from Kohima, Assam, answers well to Meijere's description.

E. marginata F., 1805.

Sys. Antl., 63. (*Hermetia.*)

(*Hermetia cingulata*) Guer. Voy. Coquille.

(*Toxocera limbiventris*) Macq. Dip. Ex. Supp. 4, 45 ; pl. v, 3.

♂ India, Singapore, Sumatra, Java, Amboina. Macquart in Dipt. Exot. Supp. iii, 176, describes the ♀ , pl. i, 9 (figures of head and wing).

In the Indian Museum a ♀ example, without data, is probably this species.

Campeprosopa Macq., 1851.

Dipt. Exot. Supp. 4, 46.

Of the two oriental species, *flavipes* has a black thorax, with lighter coloured pile, whilst *munda* possesses a metallic blue-green thorax.

C. flavipes Macq., 1851.

Dipt. Exot. Supp. 4, 46 ; pl. v, 4.

♀ Java. Long. 12 mm. Bigot Coll.

C. munda Os. Sack., 1880.

Ann. Mus. Gen., xvi, 409.

♂ Sumatra. Long. 8—9 mm.

Ampsalis Wlk., 1860.

Pr. Linn. So., iv, 98.

A. geniata Wlk., 1860 ; *l.c.*, 99.

♀ Makessar (Celebes).

Tracana Wlk., 1860.

Pr. Linn. So., iv, 99.

T. iterabilis Wlk., 1860 ; *l.c.*, 99.

♂ ♀ Makessar.

The descriptions of *Campeprosopa*, *Ampsalis* and *Tracana* all read so much alike to me that, I believe, they represent but a single genus. Walker calls the discal cell in *Ampsalis* " elongated and attenuated exteriorly," which is not mentioned in the other genera ; and he differs his *Tracana* from *Ampsalis* by the abdomen being " elongate, elliptical, attenuated at base, a little broader and longer than thorax " compared with " abdomen elliptical, a little broader but not longer than thorax."

Following Van der Wulp I have retained the genera separately, and hope that a visit to England a little later on will enable me to settle the question by an examination of all three types.

SUB-FAMILY VI.—STRATIOMYIINÆ.

Table of genera.

First antennal joint 3 to 4 times as long as 2nd	.. *Stratiomyia* Geoff.
First antennal joint at most twice as long as 2nd..	.. *Odontomyia* Meig.
First antennal joint shorter than 2nd	.. *Euceromyia* Big.

Stratiomyia Geoff., 1764.

(*Stratiomys*) Hist. d. Ins., ii, 475.

Table of species.

Antennæ unusually long—1st joint six times length of 2nd .. Long. 10-14 mm. *apicalis* Wlk.
Antennæ of moderate length.
  Legs principally black.
    Abdomen tawny, with broad black dilated dorsal band. 1st two antennal joints red .. Long. 12 mm. *parallela* Wlk.
    Abdomen black—no dorsal band; pale marks on posterior borders of segments—near sides. Antennæ black .. .. Long. 10-12 mm. *barca* Wlk.
  Legs principally yellow.
    Abdomen tawny. Thorax 2-striped, antennæ pale .. Long. 8 mm. *inanimis* Wlk.
    Abdomen black.
      Thorax 4 gold striped, base of antennæ pale .. Long. 8 mm. *confertissima* Wlk.
      Thorax unstriped, densely pubescent. Antennæ black. Long. 15 mm. *flavoscutellata* V. d. Wulp.

S. apicalis Wlk., 1854.

List. Dip. Brit. Mus., v, 53.

♀ Shanghai.

S. parallela Wlk., 1865.

Pr. Linn. So., viii, 107.

♂ Papua.

S. barca Wlk., 1849.

List. Dip. Brit. Mus., iii, 530.

♂ China. I took a ♂ each at Hankow, 22nd April 1906, and Shanghai, 9th May 1906.

S. inanimis Wlk., 1856.

Tr. Entom. So. (new ser.), iv, 121.

China.

S. confertissima Wlk., 1859.

Pr. Linn. So., iii, 79.

♀ Aru Isles.

S. flavoscutellata V. d. Wulp, 1885.

Notes Leyd. Mus., vii, 60.

♂ Java.

The genus is poorly represented in the East apparently. Three out of the six known species come from semi-Palæarctic regions. I have never taken a specimen myself in the East proper, nor is there one in the Indian Museum, nor do other authors mention any species except the three original descriptions mentioned here. I mention this because *Odontomyia*, the kindred genus, is far from uncommon.

Odontomyia Meig., 1804.

Klass. i., 128.

Table of species.

A Scutellum spined (generic character).
B Abdomen black, with lighter dorsal bands, or edges of abdominal disc pale.
C Legs mostly black.
  Abdomen, with pale dorsal band. Long. 5 mm. *minuta* Fab.
  Abdomen, with only the edges pale .. .. Long. 8 mm. *atraria* Wlk.
CC Legs mostly yellow, with or without darker bands. Abdomen black with pale edges.
  Legs all yellow; smaller species. Long. 6 mm. *bifascia* Wlk.
  Legs with or without black bands, little larger species.
    Femora and tibiæ with black bands .. .. Long. 8 mm. *æqualis* Wlk.
    Femora and tibiæ all yellow.
      Antennæ all reddish yellow. Thorax gold striped; abdomen with greenish yellow side spots .. Long. 8 mm. *viridana* Wied.
      Antennæ with base only yellow. Thorax with gold pubescence; abdomen with narrow pale border. Long. 8 mm. *cinctilinea* Wlk.
BB Abdomen pale; yellow, green, or tawny, with or without black dorsal stripe or bands.
D Legs mostly black.
  Thorax unstriped .. .. Long. 5 mm. *pusilla* Fab.
  Thorax with 2 silvery stripes. Long. 9 mm. *siderogaster* Wied.
DD Legs mostly pale, or slightly marked with black.
E Abdomen uniformly pale, without dorsal or transverse black bands.
  1. Thorax black with light hair; 3 black stripes .. .. Long. 8 mm. *finalis* Wlk.

2. Thorax black with bright red brassy pile .. Long. 5 mm. *rubrithorax* Macq.
3. Thorax black with light hair, unstriped.
   Legs entirely yellow .. Long. 8 mm. *diffusa* Wlk.
   Legs not entirely yellow.
   Posterior femora and tips of tibiæ brown .. Long. 7 mm. *claripennis* Thoms.[1]
   Femora and tibiæ tawny, coxæ more or less black .. Long. 10 mm. *lutatius* Wlk.

EE Abdomen pale, with black dorsal stripe or transverse bands.

F Legs partly black, or with distinct black rings.
1. "Posterior legs black, testaceous at base" .. Long. 9 mm. *consobrina* Macq.
2. Legs pale. 4 posterior femora and tibiæ with broad black rings .. Long. 5 mm. *ochracea* Bru. sp. nov.

FF Legs all pale (femora narrowly ringed in *immaculata*).
1. Thorax brassy .. Long. 6 mm. *solennis* Wlk.
2. Thorax pale green with yellow hair, legs reddish. .. Long. 12 mm. *ochropa* Thom.
3. Thorax black, with lighter hair.
(*a*) Small species, indistinct brown bands on femora .. Long. 5 mm. *immaculata* Bru. sp. nov.
(*aa*) Larger species—
   1. Thorax with bright tawny hair. Long. 9-11 mm. *garatas* Wlk.
   2. Thorax with whitish down. Long. 12 mm. *immiscens* Wlk.
   3. Thorax with short, golden yellow hair. Long. 8 mm. *restricta* Wlk.
   4. Thorax with silver tomentum. Long. 10 mm. *staurophora* Sch.

AA Scutellum with two exceedingly minute spines .. .. Long. 5 mm. *submutica* Bru. sp. nov.

AAA Scutellum unspined .. Long. 11 mm. *mutica* V. d. Wulp.

O. minuta Fab., 1792.

(*Stratiomys*) Ent. Sys., iv, 268.

♀ Tranquebar, East India. Type in Fab. Coll.

In the Indian Museum Collection I find 1 ♀ taken at the end of June, and have taken 2 ♀ ♀ myself in Calcutta.

---

[1] I am not quite sure that this species belongs to my sub-division E—the author's description reading "abdomen pallide flavum, limbo prasino," yet this hardly reads like a distinct dorsal stripe, or wide transverse bands.

O. atraria Wlk., 1865.

Pr. Linn. So., viii, 106.

♂ ♀ Papua.

O. bifascia Wlk., 1861.

Pr. Linn. So., v, 232.

♂ Dorey (Papua).

O. æqualis Wlk., 1861.

Pr. Linn. So., v, 271.

♀ Batjan.

O. viridana Wied., 1824.

Analec. Entom., 29.

Bengal, Ternate, Tibet.

O. cinctilinea Wlk., 1862.

Pr. Linn. So., vi, 4.

♀ Gilolo.

O. pusilla Fab., 1792.

(*Nemotelus*) Ent. Sys., iv, 268.

Tranquebar. Allied to *minuta* F. and to my new species *submutica* and *incompleta*.

O. siderogaster Wied., 1830.

Ausser. Zweifl., ii, 65.

♀ Java. Type in Westermann's Coll. Also in Leyden Museum.

O. finalis Wlk., 1860.

Pr. Linn. So., iv, 94.

♀ Makessar and Manado (both Celebes). I took one ♀ at Rangoon, 18th August 1906. The abdomen (if the species is correctly identified) is "dirty tawny black" to use a Walkerian expression, and the specimen is only 7 mm. long.

O. rubrithorax Macq., 1838.

Dip. Exot., vol. i, 185.

♂ Bengal. Macquart says it resembles *Stratiomyia cuprina* Wied, from Brazil, but that species is much larger.

O. diffusa Wlk., 1854.

List. Dip. Brit. Mus., v, 53.

♀ Java, Sumatra. I am in much doubt as to the limits of this species.

O. claripennis Thoms., 1868.

Eugenie Reise, 456.

♂ Manila. Said to be near Macquart's *albipennis.*

O. lutatius Wlk., 1849.

List. Dip. Brit. Mus., iii, 532.

♀ Malacca.

A ♀ from Siliguri, N. Bengal, in the Indian Museum dated 30th June 1906 is undoubtedly this species. The legs are all yellow, whereas Walker says " hips " black.

O. consobrina Macq., 1847.

Dip. Exot. Supp. 3, 16 ; pl. i, 8.

♂ Java, Sumatra. Macquart's diagram of the antenna shews it rather thicker than is usual in this genus.

O. ochracea mihi, sp. nov.

♂ Calcutta. Vertex and front, shining black ; lower part of head, yellowish white ; mouth black ; eyes practically, but not absolutely contiguous just above frontal triangle, diverging thence to vertex. Antennæ brown, 3rd joint black, the 1st joint a little longer than the 2nd. Thorax shining, dark aënus black, with sparse very short gold hair. Scutellum pale, base black, spines small, pale yellow. Abdomen in life—peach colour, after death—pale ochreous tawny, with a dorsal row of 4 black spots, of which the basal one is largest and triangular, the 2nd very small and round, the 3rd large and transversely oral, the 4th much smaller and of the same shape. Belly unicolorous, the last two dorsal spots being visible from below. Legs pale yellow tawny, all the femora with a broad brown ring in the middle ; posterior tibiæ and upper side of posterior tarsi dark brown. Wings quite limpid, veins invisible, except along the fore border. Long. 4 mm.

Described from 2 ♂ ♂ in the Indian Museum Collection (including the type specimen) and 2 ♂ ♂ in my own Collection—all taken in Calcutta.

O. solennis Wlk., 1851.

♂ East India. Ins. Saunds. Dip., 79.

O. ochropa Thoms., 1868.

Eugenie Reise, 456.

Manila. Very near *O. viridana* Wied. There are several specimens (♂ ♂ ♀ ♀) of a species near this one in the Indian Museum Collection, from Bangalore and Calcutta.

O. immaculata mihi, sp. nov.

♂ N. India. Long. 5 mm., length of wing 5 mm. Type in Indian Museum Collection. Head black, with very short pale hair below, a shining black tubercle immediately below antennæ, which are black, 1st and 2nd joints tawny. Eyes contiguous for a short distance thus forming a small triangle above antennæ, and another on the black vertex. Eyes large, upper facets much larger. Thorax dull black with short, meagre goldish pubescence, black below with a little short white hair at the sides. Scutellum all black, spines very short. Abdomen pale greenish or tawny, with more or less distinct traces of a pale brownish coloration on apical half; this spot may not be a natural coloration, but due to the contents of the body. Wings quite clear, veins invisible except those on foreborder, which are tawny. Discal cell so minute as to be almost invisible: alulæ bright yellow. Legs tawny yellow, anterior femora with a narrow, brown ring in middle; intermediate femora with a brown ring near tip. Tarsi tips slightly darker. One ♂ from Bhim Tal,[1] 4,500 feet, captured by Dr. Annandale, 22nd to 27th September 1906. What I believe to be the ♀ of this species, is represented in the Indian Museum Collection by a single specimen taken in Calcutta, 5th April 1907.

O. garatus Wlk., 1849.

List Dip. Brit. Mus., iii, 532.

♀ China.

O. immiscens Wlk., 1860.

Pr. Linn. So., iv, 94.

♂ Makessar. Osten Sacken describes a ♀ from Kandari (Celebes) taken April 1874, adding that he has seen Walker's type in the British Museum and believes it to be the same species, although not agreeing entirely with the description.

O. restricta Wlk., 1864.

Pr. Linn. So., vii, 203.

♂ Mysol.

O. staurophora Sch., 1868.

Novara Reise, 59.

2 ♀ ♀ Hong Kong.

O. submutica mihi, sp. nov.

♀ Bengal. In *minuta* F. group. Head above, below, front, and

[1] Also in Indian Museum collection from Bareilly and from Calcutta (June 6th). I took one ♂ at Calcutta (31st March 1907).

a wide band behind eyes, bright yellow. Eyes rather small, black facets of uniform size. A blackish brown band stretches across the vertex from eye to eye, with a central larger spot. Two large round spots on front, below vertex, two much smaller ones just below antennæ, a small spot immediately below base of antennæ, and the proboscis, black. Thorax black, with very short silvery cinereous pubescence, sides black, pleuræ pale yellow. Scutellum yellow, base black, bearing two almost microscopic spines. Abdomen pale yellow, tinged with grey, 1st segment yellow, posterior border black in centre; 2nd, yellow, occupied by a black band not reaching the sides, placed along the foreborder, and extended posteriorly in the centre, and at the sides; 3rd, 4th and 5th with black bands from anterior border, nearly to posterior border, and not reaching sides of segments; last segment very small, all yellow. Wings quite clear, veins, costal cell and stigma pale yellow. Legs yellow, femora with broad brown band about the middle, tips of posterior tibiæ, and tips of tarsi, blackish. Halteres pale green. Of the three specimens (♀) I have seen, one is in the Indian Museum, from Siliguri, and the other two I took myself in Calcutta, 5th March 1905, and 1st February 1907, in grass near ponds at Tollygunge.

O. mutica V. der Wulp, 1885.

Notes Leyd. Mus., vii, 62.

♂ Ternate. The author compares this to the North American species *nigirostris* Lw., a species which, in general facies, seems to have some resemblance to a *Lasiopa*.

This species having an unspined scutellum may perhaps be placed in a new genus, in which my *submutica* might also enter.

Euceromyia Big., 1877.

Bull. So. Ent. Fr. (1877), p. lxxiv.

E. nexura Wlk., 1859. (*Stratiomys*) Pr. Linn. So., iii, 80.

♂ ♀ Aru Isles; also from Mysol. Long. 7 mm.

In concluding these notes I wish to thank Dr. Annandale, Officiating Superintendent of the Indian Museum, Calcutta, for his kindness in affording me access to the Museum Collection and Library. They were originally intended only as a revised list of Oriental species of Stratiomyidæ for my own use, but gradually extended to their present form, and I must again attribute to the paucity of material at my command any errors or deficiencies that may be found.

I hope to visit England shortly, and shall then be able to correct any errors, at least as far as Walker's species are concerned, by an examination of his types at the British Museum. Such corrections will be incorporated in a supplementary paper and published in this journal.

ADDENDUM.

Acanthina argentea, mihi, sp. nov.

♂ Calcutta. Long. 3 mm. Eyes extending the whole height of the head shortly but not thickly pubescent, subcontiguous at nearest point of approach as the frons at this point is receding but attains the surface of the eyes towards the vertex, which is considerably raised and occupied by the ocelli; facets rather large, of uniform size. Frons, both above and below the nearest approach of the eyes, shining white. Back of head and underside of head black, inner orbit of eyes below antennæ white. Antennæ, structurally, exactly as in Wiedemann's generic description, with first two joints black, third reddish-brown with blackish marks: style thick. Proboscis short, yellowish, with a few hairs. Thorax, dorsum and sides, and scutellum black, both uniformly covered with short silvery-grey pubescence. Scutellum with four rather large whitish spines. Abdomen black, covered like the thorax with short silvery-grey pubescence. No signs of any marks or pattern on either thorax or abdomen. Belly black, with short grey hairs. Legs yellowish-white; femora black, extreme base and tips pale; tibiæ with a broad black band, leaving only the basal fourth and the tip pale. Wings and stigma absolutely colourless, but veins distinct, though pale: alulæ very small, brownish-white; halteres brownish-yellow, knob white.

Described from a perfect ♂ in the Indian Museum Collection, taken at Calcutta on 22nd May, 1907. The small size of this species will easily distinguish it from the other two species mentioned.

VII.—DESCRIPTION OF AN OLIGOCHÆTE WORM ALLIED TO CHÆTOGASTER.

By J. Stephenson, *Major, I.M.S., Professor of Biology, Government College, Lahore.*

The worm described below was found in water taken from a tank in the pleasure-gardens at Shalimar, near Lahore, in the early part of February, 1907. It lives well in water kept in small vessels with a little green alga in the laboratory, and appears to propagate itself asexually with freedom. Specimens have been under observation at various times during the last month.

External characters.—In length the animal measures from 1 to 2 mm. ; the variations are considerable, and depend principally on the stage which the asexual reproductive process has reached (*v. inf.*). There is a short blunt prostomium, followed by a region slightly swollen in an ovoid manner and corresponding to the pharynx ; the rest of the body is of uniform diameter, showing a wrinkling corresponding to the degree of contraction of the animal, but no regular annulation. The anterior end of the body is studded with a few fine hairs ; and similar hairs also occur posteriorly in the neighbourhood of the anus. The whole animal is very transparent.

Segmentation.—As just said, there is no external annulation ; the segmentation is, however, indicated externally to some extent by the bundles of setæ. The first setæ are placed ventro-laterally on the slightly swollen anterior region, and may be taken to belong to the second body-segment ; the next bundles are placed some distance further back, this achætous interval being in length equal to about three of the immediately following segments. The bundles then succeed each other regularly, being placed, however, closer together at the posterior end of the animal.

Internally the segmentation is defined by the septa, of which the first occurs at the posterior end of the pharynx, behind the level of the first bundle of setæ, and may be taken to be the posterior limit of the second segment : the next septum occurs at the posterior end of the œsophagus, similarly delimiting the third segment ; in the region of the crop there are three septa, the first of these about the junction of the anterior and middle, the second about the junction of the middle and posterior thirds, and the last near the hinder end of the crop. The second bundle of setæ occurs at the level of the posterior part of the crop, in the sixth body-segment according to the limits established by the septa. Segmentation is also evident internally in connection with the ganglia of the ventral nerve-cord and with the nephridia (*v. inf.*).

Setæ.—There are two bundles of setæ in each segment in which they occur, and there are about six setæ in each bundle ; five and seven are also met with. They are ventro-lateral in position ; the portion which projects externally is approximately equal in length to the portion within the body ; and the whole length of a seta is equal to about two-thirds the diameter of the body when the latter is in the condition of moderate extension. Each seta has the form of an elongated $\int$, the end is unequally forked, and there is a small nodulus (*v.* plate v, fig. 2).

When the animal is at rest, most of the setæ project at about a right angle ; those of the most anterior bundles, however, lie flat against the surface of the body, their free ends forwards. The somewhat hooked free ends of the setæ may point either forwards or backwards (I do not refer to the direction of the seta as a whole) ; in the setæ of a single bundle, the hooks of some may point forwards, of others backwards ; and a bundle of setæ, the hooks of which are pointing forwards, may be seen shortly afterward with hooks pointing backwards ; some of the muscular fibres attached to the setæ have, therefore, the power of rotating the setæ about their longitudinal axes. A common arrangement is for the hooks to point backwards in the anterior, forwards in the posterior segments. Backward-pointing hooks are presumably of use in forward progression, forward-pointing hooks in backward progression. The first bundles, however, appear always to have their hooks pointing backwards.

The distribution of setal bundles in the anterior part of the body is apparently subject to slight variation ; on one occasion a few small setæ were noted in the third body-segment ; in another case those of the sixth segment were fewer and smaller than normal.

Asexual reproduction.—The smallest number of segments observed was eight (*v.* plate v, fig. 3 *a*) ; the body, that is, came to an end at the end of what I have called the "stomach," and comprised only four pairs of setal bundles ; there was, in addition a commencing constriction visible, which if completed would separate off the posterior two segments. This specimen may have been pathological ; the body-cavity contained numerous clear, oval or irregular corpuscles, apparently non-nucleated, which were seen in no other specimens ; it was in this animal also that the setæ of the sixth segment were fewer and smaller than usual.

All the other animals examined were divided by a well-marked constriction into two parts, an anterior, of at least eight body-segments, and a posterior, of varying length ; these two principal divisions of the worm were usually again divided by slighter constrictions. Thus the anterior portion might consist of eight body-segments, the posterior of four setigerous segments (plate v, fig. 3 *b*) ; or the anterior of eight body-segments, the posterior of six setigerous segments (*c*) ; or the anterior of eleven body-segments, the posterior of seven setigerous (*d*) ; or the posterior portion might comprise eight setigerous segments, and be again divided into two parts each bearing four pairs of bundles, the four posterior segments of the anterior part of the body being also separated by a distinct constriction from those in front (*e*); finally, in a specimen where a deep constriction divided off an anterior portion of eleven body-segments from a posterior of eight chætigerous segments, the new prostomium, mouth, buccal cavity and cerebral ganglion of the posterior half could be distinctly seen (*v.* plate v, fig. 4). The regions of the alimentary canal which I have called "crop," and "stomach" are, however, differentiated in the posterior half of the dividing worm at an earlier stage than this. It may be noted here that the seat of the constrictions, secondary as well as primary, is always marked in addition by a conspicuous extension laterally of the nervous matter of the ventral chain; these lateral extensions spread so far as almost to meet dorsally, and this takes place on the anterior as well as on the posterior side of the actual site of constriction (*v.* plate v, fig. 5).

Figure 6 represents the site of constriction in one of the specimens examined. The anterior setal bundles of the posterior worm are seen to be developing; they thus arise as new formations, and from the first point forwards, not perpendicularly outwards. If the groups of setæ already existing posterior to these (originally the first pair behind the constriction) persist as the setæ of the sixth segment of the second worm, then each act of fission involves the intercalation of five newly-formed body-segments behind the site of constriction. The same figure shows also a group of developing setæ immediately in front of the constriction; new segments are therefore formed on both sides of the site of constriction.

Alimentary system.—The mouth is ventral, and leads into a buccal cavity of small extent. This is succeeded by the pharynx, a thick-walled tube, which extends backwards as far as the septum between the second and third segments, and is attached to the body-wall by numerous fine, short, sometimes Y-shaped muscular fibres. The œsophagus occupies the third segment, it is narrower behind than in front, and is usually short, about half as long as the pharynx; in the specimen mentioned previously as being perhaps pathological, it was of a length about equal to that of the pharynx. The crop, which follows, is a dilated portion of the canal, occupying a little more than three segments, the fourth, fifth and sixth, its posterior end being in the seventh segment; its walls are clear, and one cell in thickness; the degree of its distension varies; it may be ballooned so as to occupy the whole of the body-cavity in its own segments.

A well-marked and constant constriction separates the crop from a second dilated region of the alimentary tract, which is distinguished by being slightly pigmented, of a light yellowish-brown colour, and by containing a large number of refractile globules like minute drops of oil in its walls. It is situated in the seventh and eighth segments. The intestine occupies the remainder of the body; its diameter is less than that of the stomach but varies somewhat; the anus is terminal.

The *body-cavity* is extensive, and (with the exception already noted) was not seen to contain corpuscles. The septa are delicate partitions showing swellings indicative of nuclei (*v.* fig. 7).

Circulatory system (fig. 8).—The dorsal vessel extends from the hinder end of the body to the prostomium, and is pulsatile along its whole length except for a very short distance in front, anterior, that is, to the level of the refractile particle of the cerebral ganglion (*v. inf.*) close to which it runs; the contractions proceed from behind forwards. There are two lateral vessels, of calibre approximately equal to that of the dorsal vessel, which encircle the œsophagus, uniting ventrally with the ventral vessel; they are also contractile, the contractions progressing from above downwards. The ventral vessel cannot be traced quite as far forward as the dorsal; it is of about the same calibre, and is nowhere pulsatile. There appears to be a fine plexus of capillaries on the external surface of the crop and stomach (*v.* fig. 9). The blood is colourless and contains no corpuscles.

The *Nephridia* are much-coiled fine tubes, which, however, become thicker, with more granular walls, near their external opening; this is situated a short distance in front of the bundle of setæ of the same segment. The canal is somewhat dilated just before it opens to the exterior. I could not distinguish the beginning of the tube; no ciliary action was visible in any part of it; nor did the nephridia appear to be connected with the septum in front of them. Nephridia are constantly found in the seventh and eighth segments at the sides of the stomach; for the rest, their distribution varies (*v.* fig. 10 *a* and *b*). They are not found in any of the segments that have recently formed.

Nervous system.—The cerebral ganglion is situated far forwards, just behind the prostomium, occupying a space corresponding to the buccal cavity and anterior part of the pharynx. It is not distinctly bifid, but rather irregularly lobulated in shape (*v.* fig. 7). One particular portion, spherical in shape, slightly more refractile than the rest, and situated at the level of the junction of buccal cavity and pharynx, stands out in all specimens; posteriorly there is closely opposed to it a bright, somewhat granular mass, semilunar in shape as seen sideways (*v.* fig. 7). I am unacquainted with a similar structure in other forms, and have no suggestions to make as to its function, unless it be a degenerate otocyst.

The circumbuccal commissures are situated at the level where the buccal cavity passes into the pharynx. The subpharyngeal ganglionic mass is irregularly lobulated, broad from side to side, narrowing posteriorly to become the ventral nerve-cord. Some small lobes frequently appear entirely detached from the main nerve-mass. The ganglia of the ventral cord are placed at the level of the setæ in each segment; in the achætous interval (3-5 segm.) there are irregular swellings on the cord, which do not appear to have the definiteness of the ganglia in the following segments. The ventral cord is of considerable thickness and is always very easily seen; it is not united with the epidermis. Its double origin is perhaps indicated by its bifid anterior end and the median row of buttonhole-like perforations in its anterior portion which are shown in fig. 11.

The upward growths of nervous matter within the body-wall at the site of the constrictions have already been mentioned. The cerebral ganglion can be distinguished in the posterior portion some time before this is ready to separate.

Under an oil-immersion lens the nodulations on the ventral cord, which aggregated together form the ganglia, are seen to consist of spherical hyaline cells with nuclei, placed mostly in the dorsal sides of the cord.

Sense organs are represented by the tactile hairs, and possibly by the refractile particle in the cerebral ganglion.

No *sexual organs* have so far been observed.

The mode of examination adopted throughout has been the observation of the living animal under the microscope ; its transparency renders this easy. A stained specimen revealed comparatively little of the structure of the animal.

The predominance of asexual reproduction, together with the presence of a nervous system unconnected with the epidermis, places this form at once among the Naididæ. The total absence of hair-setæ, of dorsal setæ altogether, and of ventral setæ also in the third, fourth and fifth segments, would seem further to assign it to the genus *Chætogaster.* The definition of this genus, however, includes a reference to the third segment, which is much elongated in all forms hitherto recognised as belonging to the genus ; while in the form now described the third segment is commensurate with the œsophagus, and of no greater length than the two succeeding segments. In *Chætogaster*, also, the longitudinal commissures of the ventral cord are separate from each other in the anterior part of the body ; this can hardly be said of the form now described (*v.* fig. 11). The definitions of genera include no reference to the alimentary canal, and I cannot say whether or not the differentiation of the parts of the tract which I have called "crop" and "stomach" occurs in the various species of *Chætogaster.*

If, in consideration of the similarity in other respects of this form to the species of *Chætogaster*, it should be thought advisable to widen the definition of the genus so as to include it, I would suggest *punjabensis* as a suitable specific name ; since, besides the characters mentioned above, it differs in its length, or transparency or extent of the œsophagus, or the characters of the circum-œsophageal vascular ring, or the number of setæ in each bundle, or in more than one of these points, from the several species described by Michaelsen (*Oligochæta*, 1900) as belonging to the genus.

EXPLANATION OF PLATE V.

FIG. 1.—General view of the animal from ventral surface.
an. Anus. *an. h.* Anal hairs. *c.* Constriction. *cr.* Crop. *i.* Intestine. *m.* Mouth. *œ.* Œsophagus. *ph.* Pharynx. *pr.* Prostomium. s^1, s^2, s^3. First, second and third bundles of setæ. sg^{3}-^{7}. Third to seventh body-segments. *s. h*, Sensory hairs on anterior part of body. sp^{1}-^{5}. Septa in the anterior part of body. *st.* Stomach.

FIG. 2.—A seta.

FIG. 3.—*a-e.* Diagrams illustrating asexual reproduction.

FIG. 4.—Site of division.
b.c. Buccal cavity. *c.g.* Cerebral ganglion. *int.* Intestine of anterior animal. *sph. g.* Subpharyngeal ganglion. Other letters as before ; all except *int.* have reference to the posterior animal.

FIG. 5.—Lateral view of the site of constriction, showing lateral extension of nerve-cord in this situation.
int. Intestine. *l.e.* Lateral extension of nerve-cord. *v.n.c.* Ventral nerve-cord.

FIG. 6.—Growth of seta bundles near the site of a constriction.

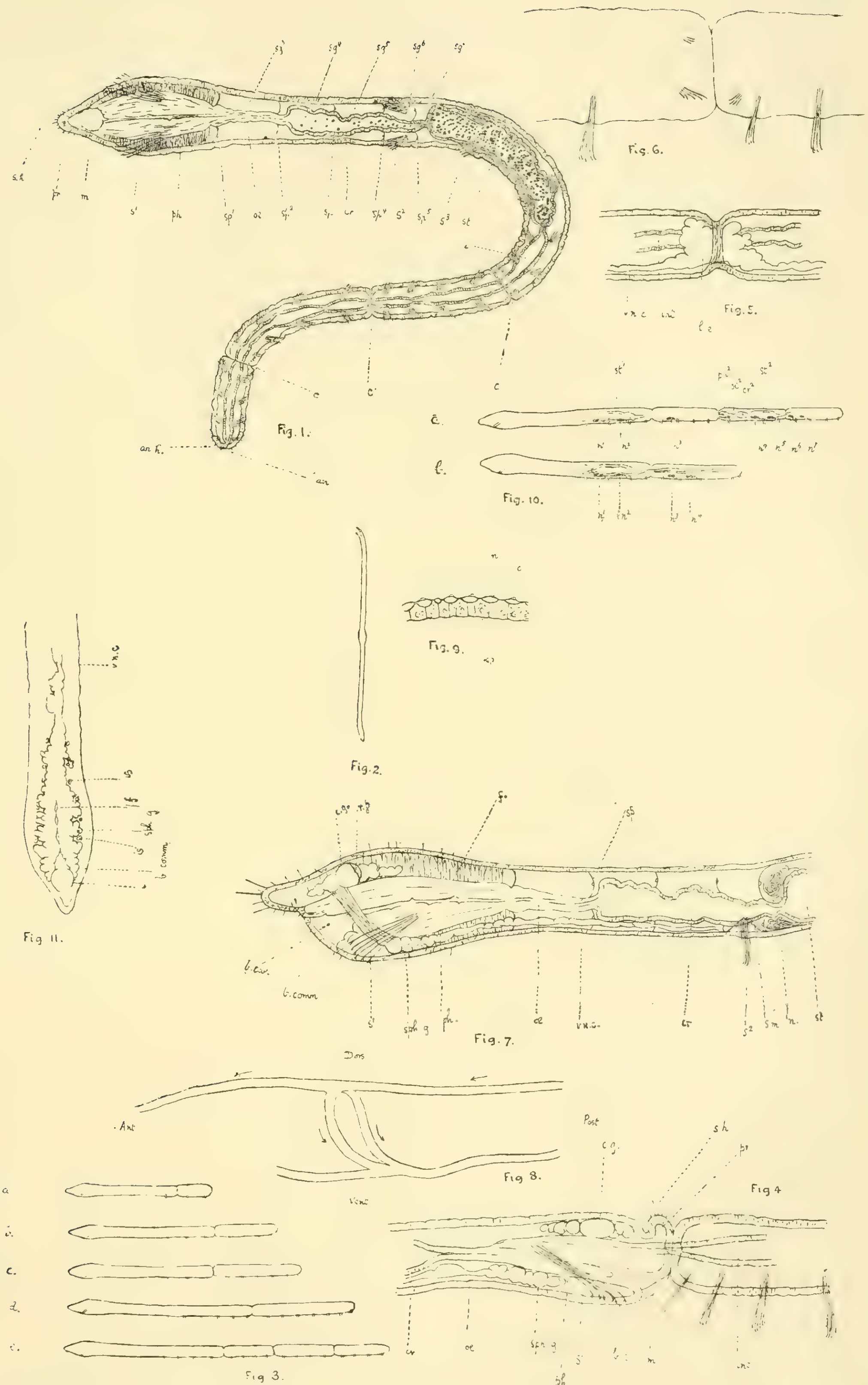
FIG. 7.—Lateral view of anterior part of body.
b. cav. Buccal cavity. *b. comm.* Buccal commissure. *f.* Fibres attaching pharynx to body-wall. *n.* First nephridium. *r. p.* Refractile particle in the cerebral ganglion. *s. m.* Setal muscle fibres. *sp.* Septum, showing a projection due to a nucleus in its substance. Other letters as before.

FIG. 8.—Diagram illustrating chief blood-vessels. The arrows show the direction of the contractions.

FIG. 9.—Part of wall of crop, showing capillary blood-spaces outside the crop epithelium.
c. Capillary blood-space. *n.* Nucleus. *ep.* Epithelium of crop.

FIG. 10.—Diagram illustrating distribution of nephridia : parts of the alimentary canal are outlined.
n^{1}-^{7}. The nephridia. st^1. Stomach of anterior animal. ph^2, $œ^2$, cr^2, st^2. Pharynx, œsophagus, crop, and stomach of posterior animal.

FIG. 11.—Anterior part of nerve-cord, seen from the ventral surface.
is. Islands of nerve-tissue isolated from the rest. *pf.* Perforations along the median line of the subpharyngeal ganglion. Other letters as before.



J. Stephenson del.

CHÆTOGASTER (?) PUNJABENSIS, sp. nov.

VIII.—THE FAUNA OF BRACKISH PONDS AT PORT CANNING, LOWER BENGAL.

PART IV.—HYDROZOA.

By N. ANNANDALE, D.Sc., *Officiating Superintendent, Indian Museum.*

Only one species of Hydrozoon, *Irene ceylonensis*, occurs at present in the ponds themselves, but two others have been found in one of the small pits close to the embankment of the river, and might easily be carried into the ponds by a flood. As the smaller pits dry up completely before the end of winter, the presence in them of these hydroids is probably accidental, coming about only when the embankment is broken and water enters from the estuary, bringing with it eggs, larvæ or medusæ. Considering the three species found in brackish water at Port Canning together, *Irene ceylonensis* is the only representative of the Calyptoblastea, the two from the pit being both Gymnoblastic; of these latter, one is an undescribed species of *Syncoryne* or possibly of a new genus, while the other must be regarded at present as identical with the European *Bimeria vestita*, from which, however, further research may ultimately prove it specifically distinct.

Syncoryne filamentata, sp. nov.

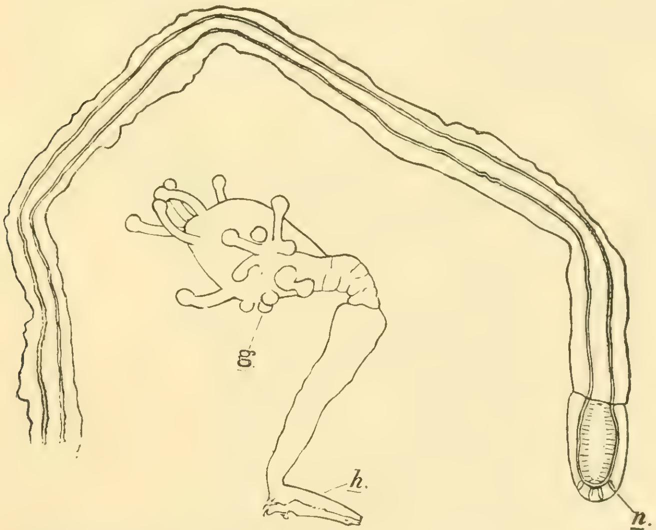


FIG. 1.—Trophosome of *S. filamentata*, × 21. Hydranth and free filament (the latter in optical section). n = nematocyst: g = gonosome: h = hydrorhiza.

Trophosome—

Colony glistening white in colour. Hydrorhiza branches sparingly, does not anastomose, gives rise at intervals to single upright polyps, and is produced at the extremities of the ultimate branches into long, free filaments, the distal ends of which are often slightly clubbed. The stem of the hydranths is obscurely annulated, their bases are surrounded by loose sheaths of the perisarc. The distal extremity of the filaments is free from the perisarc and contains nematocysts in the ectoderm. The hydranths are spindle-shaped and bear ten to fourteen capitate tentacles, which are arranged in two distinct whorls.

Gonosome—

The medusæ are borne only at the base of the inferior whorl of tentacles on the hydranths; they are minute, subquadrate in transverse section, somewhat elongate, regularly and profusely tuberculate externally, colourless. The manubrium is conical, short, incapable of being extended as far as the opening of the bell; the velum extensive; the four tentacles short and stout, capitate, without swellings except at the extremities. (This description refers only to the young medusæ before the appearance of the gonads for the later stages have not been observed.)

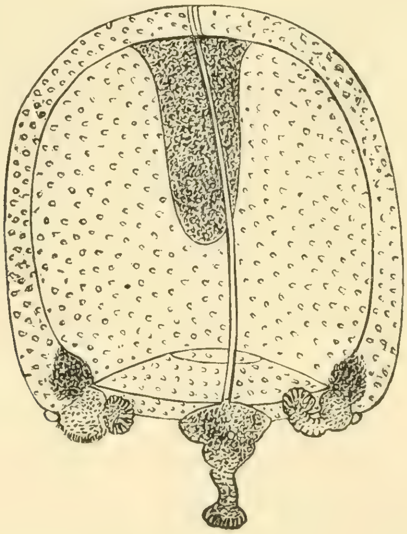


FIG. 2.—Young free gonosome of *S. filamentata*, highly magnified.

I found only one example of this species; it surrounded a grass-stem at the edge of the pit in which the next form was also taken. The spaces left vacant between the branches were filled by large numbers of a gregarious Vorticellid Protozoon, the bases of the individuals of which were inserted in a common covering of mucus and sand grains. Numerous medusæ were set free in a glass of water in December and were kept under observation for two days, at the end of which they died. Their manubria appeared to be imperforate and their tentacles remained short and stout. They moved through the water both vertically and horizontally by regular pulsations of the bell. Some specimens were killed and preserved in two per cent. formol; they became longer in proportion to their girth than was the case with living individuals in a position of rest, owing to the fact that they died with the velum in a state of contraction. The figure (fig. 2) was drawn from a living specimen; it represents the tubercles on the external surface as rather larger and more conspicuous than they really are, and only shows one of the four radial canals.

The free filaments of the trophosome are flaccid and incapable of independent movement.

Bimeria vestita, Wright.

From bricks in the river at Port Canning and from a pit of brackish water at the same place; previously recorded from northern Europe and South America.

My specimens differ in one important character from those described from Europe, namely in the extent and nature of the chitinous investment of the perisarc. Allman (*Mon. Gymn. Hydr.*, p. 298) describes "the chitinous sheaths which invest the bases of the tentacles" as "suggesting the idea of a half-gloved hand" and being of a brown colour. This is not the case in the specimens from Port Canning, in which the perisarc is of a pale horn-colour and the chitin disappears at the base of the tentacles so gradually that it is impossible to say exactly at what point it ceases. In specimens from the Matla, however, it is darker and extends further upwards than in the one from the pit. Torrey (*Pub. Univ. California*, Zool., i, p. 27) has pointed out that the extent and thickness of the chitinous perisarc, which was formerly regarded as a generic character separating *Bimeria* from *Garveia*, is liable to considerable variation in North American species, of which several have been described. Another but less noteworthy point in which my specimens differ from the typical form, is the irregular and often indistinct annulation of the stalks of the gonosomes; but

FIG. 3.—*B. vestita*; part of a colony from pit of brackish water, Ganges delta, × 16.

this cannot be regarded as a constant character. Judging from Hartlaub's figure (*Zool. Jahrb.*, 1905, suppl. vi, p. 534), his South American specimens represented a depauperated form. The Port Canning colonies, however, are vigorous, the upright stems branching freely and attaining a height of about 15 mm. All the gonosomes (in December) were female, each bearing a single egg, round which the spadix, which was simple, had coiled itself.

Irene ceylonensis, Browne.

From one of the brackish ponds at Port Canning; the medusa originally described from off the coast of Ceylon.

Trophosome—

Colony minute, barely visible to the naked eye, colourless; perisarc extremely delicate. Hydrorhiza strongly adherent, branches sparingly, does not anastomose, gives rise at intervals to single upright polyps. Hydrotheca nearly cylindrical, with a short pedicel, which is about one-seventh as long as the cup and bears more or less distinct annulations; an operculum present, consisting of a number of triangular flaps which close together above the contracted hydranth. Hydranths highly contractile, with about fourteen tentacles, which are capable of great elongation; the disk shallow; the hypostome inconspicuous.

Gonosome—

Gonosome borne on a long, more or less distinctly annulated stalk, which as a rule carries a single medusa. Two or more younger medusæ are, however, occasionally produced at the base of and at right angles to the first, the main axis of which is that of the pedicel. Each medusa is contained in a separate gonotheca, which is ovoid variable in size, always larger than the hydrotheca, and has a single aperture produced by the rupture of the membrane above; the gonophore is a simple cylindrical body. Medusa at first almost hydra-like in appearance, with the umbrella feebly developed and with four stout, tapering tentacles, by means of which progression is effected. Adult medusa measuring 20—25 mm. in diameter, the depth of the bell being less than the breadth. No cirri; tentacles about 100, some of them often represented by small tubercles; otoliths from one to four in each sense-organ, a sense-organ occurring between each pair of tentacles; four radial canals; manubrium stout, conical, colourless; stomach small; mouth surrounded by four fringed lobes; gonads colourless, consisting of linear bands and extending when mature from the base of the manubrium to the periphery of the bell.

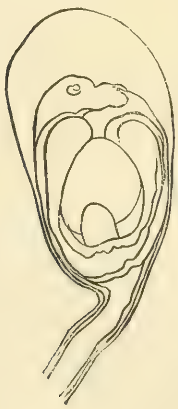


FIG. 4.—Gonotheca of *I. ceylonensis*, × 140.

The whole perisarc of the hydroid of this species is so delicate that the thecæ can only be seen with difficulty even in the living colony; in preserved specimens their outlines are always distorted. The constant presence among them, in the pond, of the very much stouter and less transparent thecæ of the Protozoon *Folliculina ampulla* was at first a source of confusion to me, until I saw both organisms expanded.

The gonosomes are produced in November, December and January. At the beginning of December (1906) the medusæ in the pond were still immature, although many of them had almost attained their full size; towards the end of the same month their gonads were ripe, while at the beginning of the next month only dead or dying medusæ could be found. By March 17th another brood had reached maturity, having probably been produced by the young gonophores observed on the colonies in January. In March, however, no hydroids were found; probably they had been killed by the increased temperature of the water, which was perceptibly warm to the hand in the middle of the day. In my aquarium they soon perished unless the glass was shaded from the direct rays of the sun. Neither medusæ nor hydroids could be found in the pond at the end of May.

A peculiarity, which may have been due to the rise in temperature, was noted in the March brood of medusæ. Those which reached maturity in December agreed with the original specimens from Ceylon in not having more than two otoliths in each sense-organ, but those taken in March had either three, four, six or eight. When three or four were present, they were arranged in a single series approximately at right angles to the periphery of the bell; but when the number was six or eight, they formed two parallel series oriented in the same manner. In some instances it was possible to see that the otoliths of smaller series were actually dividing to produce larger ones, the direction of division being always the main axis of the series. The size of the cyst was always larger when six or eight otoliths were present, and in several cases a partition had been formed between the two parallel series, dividing the cyst into two compartments. It was clear, therefore, that the cysts were multiplying by fission. Numerous new tentacles were also being produced, every stage occurring between small rounded swellings of the periphery and fully elongated tentacles. Browne (in Herdman's *Ceylon Pearl Oyster Fisheries and Marine Biology*, part iv, p. 140) remarked on these swellings and suggested that they were young tentacles, as has proved to be the case. He also observed that while the normal number of otoliths in a cyst was one, two were sometimes present. He thought it probable that this was a case of twinning, but in the light of the observations just recorded it seems more probable that it was one of division.

I have commented in the preliminary paper of this series on the survival of both hydroid and medusa in small masses of water from which a fresh supply of air was practically excluded. This was as noticeable in the March brood of medusæ as in the December one.

I did not find, however, that individuals of either brood lived for more than a few days in my aquarium, although they fed readily. Judging from the succession of broods in the pond, the life of the medusa, as might be expected, is short; while the hydroid probably does not survive for more than one cold season.

The medusæ are sluggish in their movements. As a rule they do not swim at the surface but rise up to it occasionally by a rapid succession of pulsations, and then sink again with the dorsal surface of the umbrella downwards. On reaching the bottom they generally lie still for a few minutes and then rise obliquely sufficiently high to right themselves. When this has been effected, they often make another ascent to the surface, and the manœuvre may be carried out several times in succession. While they are sinking, the velum remains expanded and the tentacles maintain their position parallel to the longitudinal axis of the bell, except when they become entangled together. The manubrium is, however, in almost constant motion, twisting in all directions and apparently removing microscopic particles from the tentacles and the ventral surface of the velum. Occasionally the medusæ move through the water obliquely for a short distance by a regular series of slow pulsations, and more frequently they float along just above the bottom, on which the tentacles and manubrium trail, in an upright position.

Although the tentacles may be used in retaining microscopic organisms, which the manubrium removes from them, larger prey is captured directly by the mouth, which picks it up from the bottom. I have on several occasions observed young examples of the small univalve mollusc *Bithinella caningensis*, Preston, which is enormously abundant in the ponds, being seized in this way. A long struggle always ensued before the medusa was able to detach and lift the prey, which, however, was finally taken into the stomach, distending it greatly. The empty shell was ejected after a few hours. Another method of feeding was also observed, in this case on a filamentous alga. The medusa attached itself by its mouth to a filament of the alga and sucked out the contents, its stomach becoming perceptibly green in the process, which lasted for some hours.

These observations were of course made on captive specimens, but there is no reason to think that the actions recorded were in any way abnormal; so little is known about the movements and feeding of medusæ that any notes of the kind have considerable interest. I could not detect evidence of either negative or positive heliotropism in the medusæ, but their powers of progression are so feeble that perhaps this was hardly to be expected. Their position in the pond appeared to be due entirely to the direction of the wind; if there was no wind, they remained close to the plants of *Nais* on which the hydroid was growing, and on which *Bithinella* was very abundant.

IX.—FURTHER NOTE ON A POLYZOON FROM THE HIMALAYAS.

By N. ANNANDALE, D.SC., *Officiating Superintendent, Indian Museum.*

In a recent note on the Indian freshwater Polyzoa (*Journ. Asiat. Soc. Bengal,* 1907, p. 92) I referred specimens from Kumaon to Ridley's *Lophopus ledenfeldi,* basing my diagnosis chiefly on the form of the statoblast. Having recently had occasion to re-examine a collection of débris from the surface of the lake (Bhim Tal) in which the specimens were taken, I have found several statoblasts which evidently belong to the same species but differ in a remarkable manner from those already described, showing close affinities to Hyatt's *Pectinatella carteri.* As intermediate forms occur I see no reason to change my opinion as regards the specific or generic identity of the Himalayan species, but it will be as well to give a more detailed description in order to avoid possible confusion in the future.

The Polyzoon occurred in small, transparent patches on the leaves and stems of water-plants, the colonies being easily detached from their support and probably having the power of changing their position. The ectocyst had all the characters of that of *Lophopus*, being swollen and hyaline, filling up the spaces between the cavities in which the polypides are placed, and completely investing the whole colony. Its external layer consisted of "star-shaped" and circular cells closely resembling those figured by Ridley (*Journ. Linn. Soc., Zool.*, xx, pl. 2). Similar cells occur in *L. crystallinus*, the smaller kind being in both species rather sub-rectangular than "star-shaped," but having the corners more or less definitely produced and the shorter extremities irregularly sinuate. The polypides were arranged on one or both sides of a single longitudinal axis, the colony being as a rule much longer than broad; but probably the regularity of this arrangement disappears in older colonies. When the polypides were retracted the external surface of the colony was smooth but slightly lobate. The tentacles were relatively very long; in a specimen preserved in formol the longest measured 1·3 mm. by 0·03 mm.; they generally numbered about thirty but were sometimes fewer. The stomach was of a bright yellow colour and was rounded at its inferior extremity. The polypides were small, as also were the colonies; the latter measured about 3—5 mm. in length, 2—3 mm.

in breadth, and the same in vertical length. The cavities in which the polypides were contained terminated bluntly below. All the statoblasts found *in situ* were rounded or truncate at the extremities, one end being often blunter than the other. As a rule they bore no processes or projections of any sort, but the whole structure was slightly curved, so that the one face was convex, the other concave; the sides were not folded in towards either face; the annulus projected very little from the surface, and the whole structure was very thin.

In a few of the statoblasts still in position in the colonies a

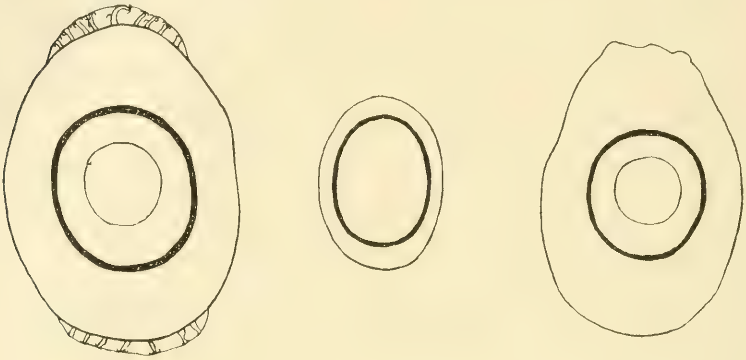


FIG. 1. FIG. 3. FIG. 2.

FIGS. 1 and 2 = statoblasts of *L. ledenfeldi* var. *himalayanus*, × 42. FIG. 3 = statoblast of *P. punctata* from Calcutta (June), × 84.

very careful examination has revealed a few short, truncate processes of the membrane joining together the valves at the extremities; but these processes are minute and have not a very definite form. The fact that their distal extremities are distinctly expanded proves that they have not been broken. The majority of the statoblasts taken on the surface of the lake were broken round the edges and especially at the ends; but a few were intact. Of these the majority were in the same condition as those still contained in the synœcium; but in a few cases processes similar to those already mentioned were found, while in one or two examples the processes were larger and better developed, although they always varied in size and number. The smallest were simply truncate and slightly expanded, but the larger ones bore at their free end a circle of minute, curved, blunt, relatively rather stout filaments, while the largest processes also bore one or two similar filaments arranged irregularly nearer the statoblasts. The processes were all flattened in the same plane as the statoblasts, and bent inwardly towards its concave face. The number of processes at the two ends of the statoblast was generally different; but in every case in which they were well developed they were arranged at either end in a graduated series, the largest in the middle and the smaller processes at either side, the largest occupying the extremity of the major axis of the valve.

As a rule the processes at one end were larger than those at the other. I have not seen more than nine or less than three processes together. Each series was enveloped in a delicate membrane. The central capsule of the statoblast was almost circular and occupied a considerable area as compared with the air-cells, being relatively larger, so far as can be judged from Carter's figure (*Ann. Mag. Nat. Hist.* (3), iii, p. 341, pl. 8, 1859), than that of Hyatt's Indian species. The colour of the capsule was dark brown, the air-cells being yellowish. Rousselet (*Journ. Quekett Microsc. Club,* 1904, p. 49) has lately placed *Pectinatella carteri,* which was found by Carter in Bombay, in a new genus (*Lophopodella*) created for an East African species, *L. thomasi*; Carter having originally assigned the former to the genus *Lophopus.* One of the most important characters of Rousselet's new genus, and indeed the only one on which he had to rely as regards the Indian species, was the nature of the processes at the extremities of the statoblast; but the absence of these processes from some statoblasts of the Himalayan species and their presence on others, forms a good ground for keeping both this species and the Bombay one in the genus to which Carter assigned the latter.

The Himalayan form agrees in every other respect with definitions of *Lophopus;* but Carter states that the specimens he found in Bombay did not have, as far as he could see, the synœcium extending to the base of the colony. Unless or until fresh specimens are found which prove divergent from the genus in other respects, I would therefore call the species *Lophopus carteri* (Hyatt). Statoblasts agreeing with Carter's description have been found in East Africa and it may therefore be expected that the species, having a wide range, will be rediscovered before very long. The Himalayan statoblasts differ from those from Bombay in the irregularity or absence of the terminal processes and the relatively greater size of the central capsule, while the synœcium of the colony appears to be more highly developed. I think it will be well to name the Kumaon form *Lophopus ledenfeldi* var. *himalayanus,* as it differs from the typical Australian variety in the following points: (*a*) the tentacles are not so numerous; (*b*) the statoblast is more irregular in outline; (*c*) the central capsule is almost circular instead of being rather elongate; and (*d*) terminal processes bearing curled, blunt hooks sometimes occur on the statoblasts. Another seemingly important difference, namely, the relatively poor development of the ectocyst in the type specimen, may very well be artificial, for structures of the kind, however carefully they may be preserved, invariably shrink in spirit. The fact that the colony described from Australia was more complex and larger than those I found in Bhim Tal, may be simply a question of age or nutrition.

Rousselet (*op. cit.*) has proposed to put *L. ledenfeldi* in Julien's genus *Hyalinella,* the status of which is very doubtful, my own opinion being that it is unnecessary to separate this genus from *Plumatella.* If Kraepelin (*Deutschen Süsswasser-Bryozoen,*

1887) is right, as I believe him to be, in regarding the forms constituting *Hyalinella* as synonyms of *Plumatella punctata*, Hancock, Rousselet's proposal is open to very grave objections. One of the most characteristic differences between *Lophopus* and *Plumatella* is the comparatively large size of the statoblasts of the former. This is well illustrated by the following table :—

FREE STATOBLASTS.

	Length.	Breadth.
1. *Plumatella princeps*, Kraepelin = same author's "*emarginata*, Reihe" ..	0·36—0·37 mm.	0·2—0·3 mm.
2. *Plumatella polymorpha*, Kraepelin = same author's "*repens*, Reihe" ..	0·214—0·53 ,,	0·2—0·413 ,,
3. *Plumatella philippinensis*, Kraepelin	0·4—0·471 ,,	0·2—0·413 ,,
4. *Plumatella javanica*, Kraepelin	0·347—0·420 ,,	0·2—0·260 ,,
5. *Plumatella punctata*, Hancock	0·4—0·54 ,,	0·27—0·41 ,,
6. *Lophopus crystallinus* (Pallas)	1—1·3 ,,	0·6—0·7 ,,
7. *Lophopus ledenfeldi*, Ridley..	0·85—0·95 ,,	0·7 ,,
8. *Lophopus ledenfeldi* var. *indica*, var. nov. ..	0·9—1·1 ,,	0·5—0·6 ,,
9. *Lophopus carteri* (Hyatt) ..	(*approx.*) 0·8 ,,	(*approx.*) 0·63 ,,
10. *Lophopus jheringi*, Meissner	1 ,,	0·8 ,,

For the figures as regards species 1, 2, 3, 5 and 6 I am indebted to Kraepelin's *Deutschen Süsswasser-Bryozoen*, and as regards 4 to the same author's account of a new species in *Mitt. Naturh. Museum Hamburg*, xxiii, p. 146; the measurements of the statoblast of the typical *L. ledenfeldi* are taken from Ridley's original description, those of that of *L. carteri* deduced from Carter's figure, and those of *L. jheringi* derived from Meissner's description in the *Sitzb. Nat. Freund. Berlin*, 1892, p. 260. *P. punctata* is not uncommon in Calcutta and its statoblasts here are generally smaller than those from Europe, although their form and proportions agree well with Kraepelin's figures. I have been unable to detect in the ectocyst of this species any trace of the cells characteristic of that of *Lophopus*.

I take the opportunity to note a description of a new Asiatic freshwater Polyzoon, *viz.*, *Pectinatella davenporti*, Oka, described from Japan in the *Zoologische Anzeiger*, vol. xxxi, No. 23, May, 1907. It is noteworthy that in the genus *Pectinatella* one species (*P. magnifica*, Leidy, from America and Europe) has hooked processes on the statoblast; one (*P. davenporti*, Oka, from Japan) has simple processes, while the third (*P. gelatinosa*, Oka, also from Japan) lacks processes altogether.

X.—REPORTS ON A COLLECTION OF BATRACHIA, REPTILES AND FISH FROM NEPAL AND THE WESTERN HIMALAYAS.

By G. A. BOULENGER, F.R.S.; N. ANNANDALE, D.Sc.; F. WALL, Major, I.M.S., C.M.Z.S.; and C. TATE REGAN, B.A.

INTRODUCTORY NOTE.

The specimens from Nepal recorded in these Reports were collected by Mr. R. Hodgart on behalf of the Indian Museum, which is much indebted to Major J. Manners-Smith, V.C., C.I.E., Resident in Nepal, for the assistance given. The specimens from Kumaon were collected at the same season as those from Nepal (in September and October, 1906) by myself, while those from the Simla district were obtained by a native collector and myself in April and May, 1907. The Nepalese localities mentioned are, for the most part, not to be found on any map. They are situated either in the neighbourhood of Katmandu, the capital of the state; in the Little Nepal Valley, which lies between that in which the capital is situated and the outermost range of hills; or in the Terai or sub-Himalayan plain. Only one or two specimens come from the last district, the majority being from the first. The specimens from Kumaon represent only two localities, Bhim Tal and Naini Tal, situated respectively at 4,500 and 6,400 feet; while the Reptiles and Batrachia from the Simla district were caught, within fifty miles of the town, between 5,000 and 9,000 feet, mostly at 5,000 and at 8,000 feet.—N. ANNANDALE.

BATRACHIA.

By G. A. Boulenger, F.R.S.

1. *Leptobrachium monticola*, Gthr.

Locality—Soondrijal, Nepal.

2. *Bufo melanostictus*, Schn.

Localities—Chitlong and Soondrijal, Nepal; Bhim Tal and Naini Tal, Kumaon; Kathgodam, foot of the Kumaon hills.

[This is the common Toad in the Nepal Valley, from which there are other specimens in the Museum, and in Kumaon up to 7,000 feet. I took a solitary tadpole of unusual size in a small pool above Naini Tal in October. As regards shape and dental formula it agreed closely with Flower's figure of a Malayan specimen (*Proc. Zool. Soc.*, 1896, p. 911, pl. xliv, fig. 3). Although this species has been recorded from 10,000 feet in Sikhim, the closely allied *B. himalayanus* is much more abundant in the Darjiling district between 5,000 and 7,000 feet.—N. A.]

3. *Rana cyanophlyctis*, Schn.

Localities—Soondrijal and Pharping, Nepal; Bhim Tal and the valley of the Balaya, Kumaon.

[This species is very abundant at the edge of the Bhim Tal (*tal*= lake) and in ditches by the roadside in the lower Balaya valley. In the Naini Tal its place appears to be taken by *R. vicina*. *R. cyanophlyctis* was seen in large numbers at Dharampur (altitude *circa* 5,000 feet) in the Simla hills at the beginning of May and several specimens were captured by my native collector. It has the habit of skipping over the surface of the water when alarmed (*cf.* Boulenger, *Faun. Brit. Ind.*, *Rept.*, p. 450), and although it is usually stated to be an aquatic species, it is only so by daylight; at night it makes considerable journeys by land. When excavations are made during building operations in Calcutta and are filled by rain water, this frog makes its appearance in them almost at once, even when they are at a considerable distance from any permanent pool.—N. A.]

4. *Rana vicina*, Stol.

Localities—Naini Tal and the upper valley of the Balaya.

The series of specimens collected by Dr. Annandale removes all my doubts as to the identity of *R. blanfordi*, Blgr., and this species (*cf.* Boulenger, *Ann. Mag. Nat. Hist.* (7), xvi, p. 640, 1905). The web between the toes may extend, as a fringe, to the disc of the fourth toe; the tympanum may be more or less distinct; the tongue is but feebly notched behind, as noticed by Stoliczka; internal vocal sacks are present in the male.

[Common at the edge of the Naini Tal and in pools by the roadside in the Balaya Valley above 5,000 feet. It is largely aquatic in its habits, at any rate during the daytime. Specimens taken at the beginning of October appeared to be breeding; the females contained large ova, while the throats and thighs of the males were suffused with a bright claret-colour, which soon disappeared in spirit. In no example seen were nuptial excrescences developed. Specimens were also taken at the end of April in a small pool of a stream, the greater part of which had dried up, at Matiana (altitude 8,000 feet) in the Simla district. With them were tadpoles, probably of the same species. The tadpoles had large suctorial lips similar to those of the tadpole of *R. liebigii*, from which, however, they differed in dental formula.—N. A.]

5. *Rana tigrina*, Daud.

Localities—Soondrijal and Katmandu, Nepal (4,000 to 5,000 feet).

6. *Rana limnocharis*, Boie.

Localities—Soondrijal, Nepal; Bhim Tal, Kumaon.

[A specimen was also taken at Dharampur in the Simla hills in May.—N. A.]

7. *Rana formosa*, Gthr.

Locality—Soondrijal, Nepal.

LACERTILIA.

By N. Annandale, D.Sc.

The collection includes examples of nine species of this group, of which species two are new. The others are common Himalayan forms, the distribution of which is rendered considerably clearer by these specimens. The occurrence of the two allied skinks *Lygosoma himalayanum* and *L. sikkimense* in the same locality is of interest; while the eastern limits of the range of *Agama tuberculata* can now be fixed with tolerable certainty.

1. *Hemidactylus nepalensis*, sp. nov.

One male specimen from Katmandu, Nepal: altitude 4,500 feet. Reg. No. Ind. Mus. Reptiles, 15779.

Diagnosis—

Allied to *Hemidactylus platyurus* (Schneid.) and to some extent intermediate between this species and *H. garnotii*, D. and B.

Head and body depressed; tail slender, flat, tapering, denticulated at the edges. A distinct fold of skin along the sides, measuring about 1 mm. in breadth, and another along the hind limbs posteriorly. Head long, slender, the length of the snout slightly exceeding the distance between the eye and the external ear; the extremity of the snout rounded. Toes webbed at the base; all the digits well developed. Dorsal surface of head and body covered with minute rounded tubercles which are almost homogeneous, but are smaller on the snout than elsewhere; dorsal surface of tail covered with minute imbricating scales; subcaudals large; ventral surface of belly covered with small imbricating leaf-shaped scales (about thirty in a transverse line across the middle of the body) changing gradually into minute tubercles on the throat. Nostril between the rostral and three small scales; eight upper and eight lower labials; one pair of chin shields meeting behind the mental and followed by several small scales on either side. An almost straight series of thirty femoral and præanal pores interrupted in the middle line. Three lamellæ under the inner, and seven under the middle posterior digit; four under the inner, and six under the middle anterior digit. The dorsal surface pale grey, marbled with a darker shade; the ventral surface immaculate white.

Length of head	13 mm.
Breadth of head	8 ,,
Length of body	33 ,,
Length of tail	45 ,,
Breadth of tail at base	5 ,,
Length of anterior limb	12 ,,
Length of posterior limb	18 ,,

I take this opportunity to figure another Himalayan Gecko (*Gymnodactylus himalayicus*) recently described by me (*Journ. Asiat. Soc. Bengal,* 1906, p. 287).

2. *Acanthosaura major* (Jerd.).

I took a fine male of this rare species just outside the town of Simla at an altitude of about 8,000 feet. The coloration was very bright but otherwise agreed with the published descriptions; there was a patch of pale lilac scales under the throat. The lizard was sunning itself on a bare bank by the roadside and appeared to be very sluggish.

3. *Acanthosaura kumaonensis,* sp. nov.

Several specimens of both sexes from Naini Tal and Mussoorie. Type Reg. No. Ind. Mus. Reptiles, 15755.

Diagnosis—

Small, slight; the body feebly compressed; the tail more than twice as long as the head and body, hardly compressed; the adpressed hind limb reaching the tympanum. Snout slightly longer than the diameter of the orbit; canthus rostralis and superciliary ridges angular; forehead sloping, slightly concave. Dorsal and medial crests continuous, reduced in both sexes to a single row of strongly keeled scales; no parallel rows of keeled scales on the back or sides. Scales on dorsal surface of head of different sizes, strongly keeled, not enlarged on the superciliary regions; six or seven upper and six lower labials; dorsal and lateral scales of two kinds, *viz.,* large, lozenge-shaped, strongly keeled tubercles and smaller imbricating scales with much feebler keels, the two being mingled irregularly; ventrals leaf-shaped, imbricate, strongly keeled, larger than throat scales; caudals strongly keeled, imbricate, of different sizes above, slightly enlarged below. Dorsal surface and sides marbled and blotched with various shades of grey and brown, with a series of large, dark angular marks on the mid-dorsal line; a broad, dark triangular band extending from the eye to the ear, its apex directed towards the eye; upper and lower lips vermiculated with black, belly white, sometimes sprinkled with minute black dots; a small triangular patch of bright blue on the throat of the male (in October).

		♀	♂
Length of head	.. ..	18 mm.	15 mm.
Breadth of head	.. ..	12 ,,	10 ,,
Length of body	.. ..	44 ,,	37 ,,
Length of tail	.. ..	126 ,,	110 ,,
Length of hind limb	..	40 ,,	35 ,,
Length of fore limb..	..	26 ,,	22 ,,

Remarks—

I have known this lizard, which appears to be not uncommon in the neighbourhood of Naini Tal and Mussoorie, for some time but have hitherto regarded it as the young of *A. major*, from which it is really quite distinct. It is allied to *A. dymondi*, Boulenger, from which it is readily distinguished by the absence of parallel rows of keeled scales on the back. There are female specimens in the Museum, taken at Mussoorie in September or October, containing eggs. The only individual I have seen in life was a male; it was caught climbing a tree in a garden in the town of Naini Tal. Another male was taken by Mr. L. L. Fermor at an altitude of about 6,000 feet in the same district. The species has evidently a restricted range, which probably does not extend beyond those parts of Kumaon and the Mussoorie district situated at moderate elevations.

4. *Acanthosaura tricarinata* (Blyth).

A single specimen from Chandragiri, Nepal: altitude 8,000 feet.

The dorsal surface of fresh specimens of this lizard has a livid green colour, which generally fades in spirit to greyish blue. The species is not uncommon at an altitude of 5,000 to 6,000 feet in British Sikhim.

5. *Calotes versicolor* (Daud.).

Several specimens from Katmandu.

This common species has a somewhat extensive range in the Himalayas. In British Sikhim it occurs at least as high as 7,000 feet, and I have seen it at about the same altitude in Kumaon. It is common at 5,000 feet in the Darjiling district and in the neighbourhood of Bhim Tal at a slightly lower altitude. Specimens from the Himalayas are generally small and have a somewhat depauperated appearance, the sexual characters being rather feebly developed; but it is not always possible to distinguish between such specimens and examples from Lower Bengal. A female was found in May at Kurseong (5,000 feet) whose oviduct contained large eggs still devoid of a shell. In Calcutta the young are hatched at the beginning of the rains and apparently take at least two years to reach sexual maturity. The breeding season is in progress as early as April.

6. *Agama tuberculata*, Gray.

Several specimens from Chitlong, Little Nepal Valley, and two from near Simla (8,000 feet).

In Kumaon this species is common as low as 4,000 feet, and I have seen it even lower. It has been taken, however, in the western Himalayas as high as 12,000 feet. It would appear to range considerably further east in the Himalayas than any other species of the genus ; but *Agama himalayana*, which was originally described from Ladak, is found, north of the hills, in the Lhasa district. Despite the fact that it must be able to endure a very low temperature when hibernating during winter, *A. tuberculata* is sensitive to cold while active. It is found as a rule on bare rocks, and even on the walls of houses, on which the sun is shining. Even a passing cloud causes it to retire immediately. The posterior surface of the thighs and the throat were suffused with sky-blue in male specimens taken (both in Nepal and in Kumaon) in September and October. The young are apparently hatched at that time of year in Nepal.

We have long had in the Museum specimens of the species from Kashmir and from Quetta. The species is abundant in the Simla hills, but specimens from this district differ in colour from those taken in Kumaon and Nepal. In the eastern race the dorsal surface is of a very dark slate-colour, with numerous spots and blotches of yellow ; while in the Simla form the back is of a rather pale brownish-grey with fewer and less conspicuous spots. The Simla form is more wary and agile than the eastern one.

7. *Mabuia macularia* (Blyth).

A single specimen from the Terai (sub-Himalayan plain) near Raxaul.

8. *Lygosoma sikkimense*, Blyth.

Numerous specimens from Chitlong, Little Nepal Valley, and one from Katmandu.

This species appears to be as common in the Little Nepal Valley as it is in British Sikhim. There is no evidence that it ranges further west than Nepal and it is certainly replaced in Kumaon by *Lygosoma himalayanum.* I recently recorded a specimen from Simla (*Journ. Asiat. Soc. Bengal*, 1905, pp. 146, 149), but a re-examination of this specimen which is in a bad state of preservation, convinces me that I was wrong in my identification. *L. sikkimense* is fond of sunning itself on stones and dry paths.

9. *Lygosoma himalayanum* (Günth.).

A single specimen from Chitlong.

This specimen (plate vi, fig. 3) is not quite typical. Its total length is 168 mm., of which the tail accounts for 108 mm. ; the colours are brighter than usual and the longitudinal streaks more conspicuous, but it is difficult to find any very definite difference in this respect. There are no projecting lobules or granules at the edge of the ear opening. On the whole, I cannot say that there is any distinction between this specimen and others from further west which would justify its being regarded as representing even a local race; but it is certainly larger and brighter than the majority of specimens I have examined. It has thirty scales round the middle of the body. The " obscure dark edging " of the ventral scales of this species to which I have referred in the paper cited above, appears to be entirely due to bad preservation of the specimens examined. *L. himalayanum* is by far the commonest skink in Kumaon between 4,000 and 7,000 feet. There are specimens in the Indian Museum said to come from the plains, but their history is one which has proved untrustworthy in other instances and I think that the locality attributed to them is incorrect. The habits of *L. himalayanum* differ somewhat from those of *L. sikkimense*, as the former appears to avoid the sun and is often found in rather damp situations. It is very abundant on the banks of the lake at Naini Tal (6,400 feet) and in gardens in the town of Simla, in the neighbourhood of which it is common at least as high as 9,000 feet. Males taken in this district in April and May had a lateral stripe of orange or bright reddish-brown running along the body below the dark lateral band. This conspicuous stripe was absent from females taken at the same season and from specimens of both sexes examined in Kumaon in autumn. The oviducts of the females contained eggs in May but not in September.

EXPLANATION OF PLATE VI.

FIG. 1.—*Gymnodactylus himalayicus*, Annandale.
FIG. 2.—*Hemidactylus nepalensis*, sp. nov.
FIG. 3.—*Lygosoma himalayanum* (Günther), from the Little Nepal Valley.
FIG. 4.—*Lygosoma sikkimense*, Blyth, from the same locality.

OPHIDIA.

By F. Wall, Major, I.M.S., C.M.Z.S.

I am indebted to Dr. N. Annandale for giving me an opportunity of examining a small collection of snakes from Nepal, and permitting me to make the following remarks upon them.

Among the twenty specimens, eleven species are represented, most of which are common.

The names used are those applied by Boulenger in his *Catalogue of Snakes in the British Museum*, 1893-96.

The specimens are as follows :—

1. *Python molurus.*

The head and part of the body are preserved of a small example from Bichiakoh, Nepal Terai.

[Occurs at least as high as 5,000 feet in Kumaon, and is said to be found occasionally at Darjiling (6,000 feet)[1].—N. A.]

2. *Tropidonotus piscator.*

There are two examples from Pharping (5,000 feet). These are greenish olive, and somewhat indistinctly chequered, the darkish spots being ill defined and smaller than the interspaces.

[Common in the Bhim Tal.—N. A.]

3. *Tropidonotus platyceps.*

An example from Pharping (5,000 feet). Quite typical.

4. *Tropidonotus stolatus.*

Four examples from Gowchar and Pharping (5,000 feet). Quite typical.

[Common at Bhim Tal.—N. A.]

5. *Tropidonotus chrysargus.*

Two small specimens from Chitlong, Little Nepal Valley, I have little hesitation in referring to this species. They are nearly uniform olive-green in colour, with two white dots on the head, one on each parietal shield. The upper lip is white, abruptly defined above. The labial sutures are not pigmented. In A specimen the chin shields are finely specked with grey ; in B purely white. There are some shield differences between the two specimens which, however, I do not consider sufficient to separate them, as they agree in other respects.

A specimen.—Ventrals 173. Subcaudals 80. Nasal shields touch the first supralabial only. Temporals 2 + 2.

B specimen.—Ventrals 184 ? Subcaudals 88. Nasal shields touch the first and second supralabials Temporals 1 + 1.

The scales in both are 19 in anterior and midbody, 17 at a point two headslengths before the vent. The labials are 8, with the third, fourth and fifth touching the eye in both specimens.

6. *Trachischium tenuiceps.*

Two quite typical specimens are from Chandragiri (8,000 feet).

7. *Lycodon aulicus.*

One example of Boulenger's Variety D (*Catalogue*, vol. i, p. 353) from Katmandu, Nepal Valley (4,500 feet).

---

[1] Rai Bahadur R. B. Sanyal tells me that he has seen a specimen killed near the town of Darjiling.—N. A.

8. *Zamenis mucosus.*

There are two specimens, one from Gowchar, the other from Kakani, Nepal.

9. *Dipsadomorphus multifasciatus.*

With little hesitation I refer two specimens obtained from Chitlong to this species.

Both agree in the following ways : The scales are 21 in anterior and midbody, 15 at a point two headslengths before the vent. The vertebral row at midbody is but moderately enlarged. The præocular is well separated from the frontal. The supralabials eight, with the third, fourth, and fifth touching the eye. Temporals two anterior. Posterior sublinguals quite separated by two small pairs of scales. The horizontal diameter of the eye equals its distance from the anterior edge of the nostril. They are both marked with oblique, equidistant, costal dark lines.

A specimen is pinkish-brown, almost dove coloured. The ventrals are 233 and the subcaudals 106 ?

B specimen is pink. The ventrals are 232 and subcaudals 102.

10. *Lachesis monticola.*

Two good examples are from Kakani and Chitlong, and quite typical. In A specimen the scales are 23 in the anterior and midbody, 21 at a point two headslengths before the vent. The ventrals are 153, subcaudals more than 40 (tail imperfect).

B specimen has the scales 23 in the anterior and middle parts of the body, 19 at a point two headslengths before the vent. The ventrals are 148 and subcaudals 48.

11. *Lachesis gramineus.*

One example from Katmandu (4,500 feet). It is uniform green dorsally, with a white flank line continued well on to the tail. The belly is greenish posteriorly, white anteriorly. The ventrals are 170, and subcaudals 57. Scales 21 in midbody.

[Major Manners-Smith tells me that it is a common belief in Nepal that there are no poisonous snakes in that country. In Sikhim and Kumaon, however, the cobra, the hamadryad, and Russell's viper are known to range to a considerable altitude. The only snake which I saw in the Simla district was *Ancistrodon himalayanum*, a specimen of which was killed by my companion Mr. I. H. Burkill at an altitude of about 9,000 feet near Matiana.—N. A.]

FISHES.

By C. Tate Regan, B.A.

The fishes sent by Dr. N. Annandale have been referred to seven species, one of which is new to science.

CYPRINIDÆ.

1. *Barbus ticto*, Ham. Buch., Bhim Tal (lake), Kumaon, 4,500 feet.

2. *Oreinus richardsonii*, Gray and Hardw., Soondrijal, Nepal.

3. *Diptychus annandalei*, sp. n.

Depth of body $3\frac{2}{3}$ to 4 in the length; length of head $3\frac{3}{5}$ to 4. Snout as long as or shorter than eye, the diameter of which is 3 (young) to $3\frac{2}{3}$ in the length of head, and nearly equal to the inter-orbital width. Two barbels on each side, the anterior much shorter than the posterior, which is not, or scarcely longer, than half the diameter of eye. Body nearly entirely naked. Dorsal II 8; origin equidistant from snout (young) or middle of eye and base of caudal, longest ray about $\frac{3}{5}$ the length of head; free edge of the fin straight. Anal II 6, when laid back not reaching the caudal; free edge slightly convex. Pectoral $\frac{2}{3}$ the length of head, not reaching the ventrals, which are inserted below the origin of the dorsal. Caudal forked. Caudal peduncle $1\frac{1}{4}$ to $1\frac{1}{2}$ as long as deep. Greyish; a few dark spots on the sides; a dark lateral stripe; dorsal and caudal dusky, lower fins pale.

Total length, 70 mm.

Pharping, Nepal.

The description is based on three specimens; the species differs from others of the genus in having two pairs of barbels.

4. *Basilius bendelisis*, Ham. Buch., Bhim Tal (lake).

SILURIDÆ.

5. *Saccobranchus fossilis*, Bl., Katmandu.

6. *Euchiloglanis blythii*, Day, Pharping.

In a recent paper (*Ann. Mag. N. H.* (7), xv, 1905, pp. 182-185) I have shown that the fishes which have been usually placed in the genus *Exostoma*, Blyth, fall into three very distinct groups which should be regarded as genera. For one of these I revived the name *Chimarrhichthys*, Sauv., 1874, but as was pointed out by O'Shaughnessy (*Zool. Record*, 1874) this is preoccupied, and I therefore propose to substitute for it the new generic name *Euchiloglanis*.

OPHIOCEPHALIDÆ.

7. *Ophiocephalus punctatus*, Bl., Bhim Tal (lake), Pharping and Katmandu.

A.C. Chowdhary, del & Lith.

HIMALAYAN LIZARDS

XI.—THE FAUNA OF BRACKISH PONDS AT PORT CANNING, LOWER BENGAL.

PART V.—DEFINITION OF A NEW GENUS OF AMPHIPODA, AND DESCRIPTION OF THE TYPICAL SPECIES.

By the REV. THOMAS R. R. STEBBING, *M.A., F.R.S., F.L.S., F.Z.S.*

AMPHIPODA GAMMARIDEA.

Family Gammaridæ.

1906. *Gammaridæ,* Stebbing, in Das Tierreich, Lieferung 21, pp. 364, 729.

Quadrivisio, n. g.

Eyes four, separate, well developed. First antennæ the shorter, with elongate accessory flagellum. Upper lip with rounded distal border. Mandibles with slender palp, the second joint longer than the first, but not longer than the third. First maxillæ having the inner plate fringed with numerous setæ, the second joint of the palp large. The second maxillæ fringed along the inner margin of the inner plate. Gnathopods subchelate, first pair small, second very large in the male, small and differently constructed in the female. Third uropods much produced, the rami subequal, foliaceous. Telson small, cleft to the base.

By the character, though not by the number, of its eyes, the species for which this genus is instituted, appears at present to be unique. In the Ampeliscidæ four eyes are common, but they are externally simple. In the Synopiidæ and Tironidæ there are species with four eyes, but in both cases the lateral pair are minute, and in *Synopia* the dorsal pair coalesce at the top of the head. In *Hirondellea trioculata*, Chevreux, the number is definitely only three, the dorsal breadth of the head being occupied by one large oval eye, not as in the present instance, finding room for two well separated organs of vision to supplement the fully developed lateral pair.

In other respects the genus has characters already known in the family Gammaridæ, though not in precisely the same combination. The third uropods resemble those in *Megaluropus*, Norman, a genus in several other features very distinct from the present. Sexual difference is here marked by the smaller size of the female and characters affecting the antennæ as well as the gnathopods.

Quadrivisio bengalensis, n.sp.

(Plate VII.)

Head much longer than first segment of peræon, rostral projection minute, ocular lobes rounded. Second and third side-plates rather deeper than first and fourth, the fourth excavate behind for the anterior margin of the bi-lobed fifth. Postero-lateral angles in the large pleon segments 1—3 produced into a very minute tooth. The fourth and one or two other of the pleon segments carry on the hind margin a widely spaced pair of denticles, very small and difficult to observe. The telson is small, not so long as broad, divided to the base, each lobe having several little spines down the inner margin, and some of those round the apex close-set.

Eyes dark, placed near the margin of the head, all with numerous lenses, the lateral pair rounded, the dorsal pair crescent-shaped, with the concavity in front.

First antennæ.—First joint rather stout and long, second much thinner, in male longer than the first, in female subequal to it; third joint small, flagellum nearly as long as peduncle, having in the male more than twenty joints, the long and slender accessory flagellum ten-jointed.

Second antennæ.—Peduncle very elongate, especially in the male, gland-cone prominent, fifth joint in male considerably longer than the long fourth joint, both slightly curved; in the female the fifth joint straight, not longer than the fourth, the flagellum shorter than the peduncle, attaining the number of 17 joints, which is slightly exceeded in the other sex.

Mandibles.—Cutting edge six-dentate, accessory plate stronger on the left than on the right mandible, spines of spine row numerous, molar strong, palp slight as in *Melita obtusata* (Montagu) and, among the Atylidæ, in *Nototropis swammerdamei* (Milne-Edwards); the third joint slightly longer than the second, tipped with two long setæ.

First and second maxillæ.—These show a remarkable resemblance to those of *Ceradocus rubromaculatus* (Stimpson), and present the same difficulty in counting the spines on the outer plate of the first pair, which are not fewer than nine, but may be eleven.

Maxillipeds.—Outer plate not reaching end of palp's long second joint. The third joint of the palp appears to be less elongate in the female than it is in the male.

First gnathopods.—The fifth joint is considerably larger than the sixth, strongly fringed on and near the hind margin with groups of spines planted on the inner surface; the sixth joint oblong oval, with scale-like spinules along the hind margin, and seven rows of spines on the inner surface adjacent to the front margin, the palm very short transversely rounded, not overlapped by the small finger.

Second gnathopods.—In the male the fourth joint has the hind margin produced to a sharp apex, the fifth joint distally cup-like, not longer than broad, the sixth longer and much broader than the second, with smooth nearly straight front margin, the hind margin slightly setose and denticulate till it meets the very oblique palm, over which the powerful finger closes, leaving two gaps, a small one near the hinge, a long one near the hind margin, with a squared denticulate process between them. In the female the fifth joint is not cup-like, longer than broad, densely fringed on the hind margin ; the sixth joint is not longer than the second, the hind margin and most of the front carrying numerous spines, the palm spinulose, oblique, leaving no gaps between it and the closed finger.

Peræopods.—The first and second pairs are slender, the fourth joint longer than the fifth or sixth. The third pair is shorter than the fourth or fifth ; in each the second joint is expanded, but more so in the upper part of the last pair, this joint also having its sinuous hind margin rather more strongly serrate than is the case in the third and fourth peræopods. The fingers are not very large, each with a distinct unguis. The branchial vesicles are simple, large in the second gnathopods and first and second peræopods, diminishing successively in the next two pairs. The marsupial plates are narrow.

Pleopods.—These are narrow, with elongate rami, the inner rami of each pair closely contiguous.

Uropods.—The first pair have the peduncles slightly longer than the equal rami, with a strong spine near the base of the outer margin, and two longitudinal rows of spines ; the shorter second uropods have the peduncles about as long as the subequal rami ; the third pair extend back much beyond the second, the elongate oval rami being only a little unequal and fringed with numerous little spines and setules ; this pair is very easily detachable. Length of male, if straightened out, about 12 mm., female considerably smaller.

Locality.—Port Canning, Lower Bengal, brackish pools. The generic name refers to the fourfold organs of vision, the specific name to the province in which Dr. Annandale discovered this notable species.

EXPLANATION OF PLATE VII.

Quadrivisio bengalensis.

n.s. Line indicating natural size of specimen figured in lateral view.

a.s., a.i.; a.i. ♀. First and second antennæ of male; second antenna of female.

oc. Front of head flattened to show the four eyes.

l.s.; *m.* ♀., *l.i.* ♀; *mx.* 1, *mx.* 2; *mxp.* Upper lip; mandibles and lower lip of female; first and second maxillæ, and maxillipeds.

gn. 1, *gn.* 2; *gn.* 2 ♀; *prp.* 2, 3, 4, 5. First and second gnathopods of male; second gnathopod of female; peræopods, second to fifth, second and fifth incomplete.

T. urp. 3. Telson and third uropod.

The mouth-organs, with part of gn. 2 and the telson, are magnified on a higher scale than the other details, and parts of the mandibles more highly still.

Del. T. R. R. Stebbing.

J. T. Rennie Reid, Lith. Edinr.

QUADRIVISIO BENGALENSIS, n. g. et. n. sp.

XII.—NOTES ON ORIENTAL DIPTERA.

I.—NOTE ON *SPHYRACEPHALA HEARSEYANA* WESTWOOD, WITH A LIST OF THE ORIENTAL SPECIES OF DIOPSINÆ.

By E. BRUNETTI.

The capture by Dr. Annandale at Lucknow on April 26th this year of *Sphyracephala hearseyana* in great abundance on the roof of a dry drain, brings it to my memory that on December 4th, 1904, I found the same species in the utmost profusion at the old Residency at that city, where the specimens were clustered very thickly together on the inside walls of the ground floor of that deserted building. On being disturbed, they hovered for a moment or two, and then settled again. The same species was found by me at Cawnpore a few days earlier, there too in extreme profusion, on the shady side of, and beneath, a low arch spanning a nearly dry ditch by the main road. I thought the blackness on the wall was only dirt, until my native servant called my attention to the insects, of which I took a large supply,—this species being the only one I have myself taken in the East.

The short thick eye-stalks easily separate this species (and genus) from all other Oriental Diopsids, except the congeneric *cothurnata* Big., which is separated from it by its wings being marked instead of quite clear as in *hearseyana*.

It would appear that the species of this family are addicted to collecting in swarms on occasion, as Doleschall, writing in 1856, mentions *Diopsis dalmanni* Wied. (*attenuata* Dol.) as swarming over stagnant water at Djokjokarta, Java; while Westwood, still earlier (1837), speaks of *Teleopsis sykesii* Gray (*Diopsis id.* of Westwood) as swarming at Hurreechunderghur, in the Western Ghauts of the Deccan (altitude 3,900 feet); its habitat being woody spots in ravines or woody hillsides, where the flies were to be found clustering together on the rocks illumined by the sun or hovering in such sun rays as pierced the foliage.

Twenty-three species appear to be Oriental, distributed amongst *Diopsis*, *Teleopsis* and *Sphyracephala*, all of which are legitimate genera; but it appears to me impossible, or at any rate inadvisable, to subdivide *Diopsis* or *Teleopsis*, especially on such variable and difficult characters to estimate with certainty as the length of the eye-stalks, thoracic and scutellar spines, etc., as has been done by Rondani in establishing *Diasemopsis* and *Hexechopsis*.

One of the above-mentioned twenty-three species is *Diasemopsis rufithorax* Big., represented by a single example in the Indian Museum Collection; its name appears to be merely a "*nomen nudum*," as I can find no description of it anywhere.

A second species by the same author, the description of which is also untraceable, is *Diasemopsis fenestratus*, likewise in the Indian Museum Collection, but this latter species is certainly only *Diopsis quadriguttata* Wlk.

Besides the truly Oriental species, *Diopsis arabica*, from Arabia, is described by Westwood.

To those who desire to study this very interesting group may be recommended Westwood's monograph of the species known up to 1837 (including *Achias*, a genus now removed from this sub-family to the *Ortalinæ*), published in the Trans. Linnean Soc., Lond., vol. xvii, which volume also contains a short supplement by the same author, giving a few additional species.

In the "Annales" of the French Entomological Society, vol. iv (series 5), Bigot gives a list of the known species up to 1874.

Van der Wulp describes the Javan species in Tijd. voor Ent., vol. xl, 181, with a plate. A revision of the synonymy shows some alterations from this author's South Asian Catalogue, and the following list of species incorporates, I think, the latest results:—

DIOPSIS L., 1775, Diss. Upsal.

1. *dalmanni* Wied., 1830. Ausser. Zweifl., ii, 560; pl. x-a, 4.
   Also figured by Westwood, Tr. Linn. So., xvii, 309; pl. ix, 17; and pl. xxviii, 8.
   (*attenuata* Dol.) 1856, Nat. Tijd. Ned. Ind., x, 413; pl. viii, 2.
   (*latimana* R.) 1875, Ann. Mus. Gen., vii, 445.
   (*lativola* R.) 1875, Ann. Mus. Gen., vii, 446.
   Java, Sumatra Borneo.
2. *confusa* Wied., 1830. Ausser. Zweifl., ii, 563.
   (*ichneumonea* F.) 1805, Antl., 201.
   nec D. ichneumonea L., which is an African species.
   Sumatra. Also occurs on the Congo and in Angola.
3. *circularis* Macq., 1835. Hist. Dipt., ii, 486.
   Figured by same author in his Dip. Ex., ii, 3, 239; pl. xxxii, 1.
   Java.
4. *subfasciata* Macq., 1843. Dip. Ex., ii, 3, 238; pl. xxxii, 3.
   Java.
5. *subnotata* Westw., 1848. Cab. Or. Ent., 37; pl. xviii, 2.
   (*argentifera* Big.) Ann. Soc. Ent. Fr. (5), iv, 112.
   Celebes, Philippines.

Four specimens of this species are in the Indian Museum Collection (one being named by Bigot as his *argentifera*) from Tenasserim, Margherita and Sadiya.

6. *indica* Westw., 1837. Tr. Linn. Soc., xvii, 299; pl. ix, 6.
   (*westwoodi* De Hann in Westw.) Cab. Or. Ent., 37; pl. xvii, 1.
   (*apicalis* Dol.) Nat. Tijd. Ned Ind., x, 413; pl. ix, 3.
   (*graminicola* Dol.) *loc. cit.*, xiv, 417.
   Java.
7. *quinqueguttata* Wlk., 1857. Proc. Linn. Soc., i, 36; pl. ii, 7.
   Mount Ophir; Borneo.
8. *quadriguttata* Wlk., 1857. Proc. Linn. Soc., i, 37; pl. ii, 6.

Specimens of this species are in the Indian Museum Collection from Tenasserim, Margherita, Kurseong and Bhim Tal (4,500 feet), the two specimens from the last locality having been captured by Dr. Annandale between September 19th and 22nd, 1906. Dr. Annandale tells me that the individuals of this and probably other species hover over broad-leaved plants in shady places in the jungle and often alight singly or in pairs on the leaves, on which they run about very much like ants.

Diasemopsis fenestrata Big., the type of which is in the Indian Museum Collection, from Margherita, appears to be a "*nomen nudum*" and in any case it is a synonym of *quadriguttata* Wlk.

9. *discrepans* Wlk., 1857. Proc. Linn. Soc., i, 134.
   Borneo.
10. *detrahens* Wlk., 1860. Proc. Linn. Soc., iv, 161.
    Macassar (Celebes).
11. *villosa* Big., 1874. Ann. Soc. Ent. Fr. (5), iv, 114.
    Borneo.
12. *ferruginea* Roder., 1893. Ent. Nach., xix, 235.
    Ceylon.

TELEOPSIS Rond., 1875. Ann. Mus. Gen., vii, 443.

1. *sykesii* Westw., 1837. Tr. Linn. Soc., xvii, 310; pl. ix, 18, 19.
   (*Diopsis id.* ♂ ♀.)
2. *fallax* Big., 1874. Ann. Soc. Ent. Fr. (5), iv, 111. (*Diopsis.*)
   Borneo.
3. *belzebuth* Big., 1874. Ann. Soc. Ent. Fr. (5), iv, 113. (*Diopsis.*)
   Borneo.
4. *breviscopium* Rond., 1875. Ann. Mus. Gen., vii, 443.
   Borneo.
5. *longiscopium* Rond., 1875. Ann. Mus. Gen., vii, 444.

Borneo. A specimen in the Indian Museum Collection from Tenasserim is probably this species.

6. *fulviventris* Big., 1880. Ann. Soc. Ent. Fr. (5), x, 94.
   India. Type in the Bigot Collection.
7. *motatrix* Ost. Sack., 1882. Berl. Ent. Teit., xxvi, 236, fig. 13 (wing).
   Philippines.

8. *selecta* Ost. Sack., 1882. Berl. Ent. Teit., xxvi, 236, fig. 13 (wing).
   Philippines.
9. *rubicunda* V. der Wulp, 1897. Tijd. v. Ent., xl, 196 ; pl. viii, 6.
   Nias (Java).

In the Indian Museum Collection is a specimen of *Teleopsis* from Tenasserim which does not appear to be any of the described species.

SPHYRACEPHALA Say., 1828. Amer. Entom., iii, pl. 52.

1. *hearseyana* Westw., 1884. Tr. Entom. Soc. Figured by him in Cab. Or. Ent., pl. xviii, 4.

Bengal ; Lucknow ; Cawnpore. A single specimen from Bhim Tal, taken by Dr. Annandale between September 22nd and 27th, 1906, is in the Indian Museum Collection.

2. *cothurnata* Big., 1874. (5) iv, 115. (*Diopsis.*)
   Celebes ; Philippines.

Diopsis trentepohlii Westw. in Trans. Linn. Soc., xvii, 546 ; pl. xxviii, 6, introduced into Van der Wulp's Catalogue as from East India, is an African species (Guinea), as noted in the author's corrections to his Catalogue in Tijd. v. Ent., xlii.

II.—PRELIMINARY REPORT ON A COLLECTION FROM SIMLA

made in April and May 1907.

By E. BRUNETTI.

The specimens dealt with in this report are from places of various altitude in the vicinity of Simla, and were captured by Dr. Annandale and his native assistant this year between April 24th and May 8th. In all, there are about 130 species, and, considering the late season, snow still persisting in sheltered spots, this seems a very satisfactory result for a fortnight's work.

The more I see of the Himalayan Diptera, the more I am inclined to consider that it belongs faunistically to the Palæarctic Region, and not to the Oriental, except as regards the lesser heights on the southern side.

I collected a fair amount of material in 1905 and 1906 during two visits to Mussoorie and one to Darjiling, and the Simla material now under examination strikingly resembles my Diptera from the other two localities, all the collections containing a considerable proportion of European species, these latter, moreover, retaining in most cases their typical form. This is conspicuously the case in the present instance as regards the family Syrphidæ, of which, out of twenty-five species captured, I have identified positively ten as commonly distributed European species, showing no variation whatever, whilst among the unnamed remainder some will in all probability prove to be European also. *Scatophaga stercoraria* L., the very common dung fly of Europe and North America, is not recorded from the East proper, yet it is as common at Mussoorie, Darjiling and Simla as in accepted Palæarctic localities like Hong-kong, Shanghai, Hankow and Japan, in all of which places I found it as abundant as in Europe.

I am hoping to make more extensive studies on the Dipterological hill fauna of India at no distant date, but at present it seems to me that at an altitude of 5,000 or 6,000 feet (almost certainly at 7,000) the Dipterous fauna at least, is much more Palæarctic than Oriental.

The exact localities with altitudes and dates referred to in this report are given first, to avoid repetition after the various species mentioned.

Simla, 7,000 feet, April 24th to 26th and May 4th to 8th.
Theog, 8,000 feet, April 27th and May 1st to 3rd.
Matiana, 8,000 feet, April 28th to 30th.
Phagu, 8,700 feet, May 3rd to 4th.
Dharampur,[1] 5,000 feet, May 6th to 8th.

Of *Mycetophilidæ* about a dozen specimens, representing nearly this number of species.

Bibio obscuripennis Meij. Matiana. In large numbers, first appearing on April 30th near flowering crab-apple trees, on which, however, they did not settle. I found the same species abundant at Darjiling one day in October, 1906, and there is a series from Nepal, also taken in October, in the Indian Museum. This raises the question of the species being possibly two-brooded.

Bibio sp. Three males of a second smaller species, black with reddish legs, black body and clear wings with black stigma.

Plecia melanaspis Wied. One specimen from Theog.

Plecia fulvicollis F. Theog, Phagu. Two females are apparently this species, but the short vein running from the third longitudinal vein to the costa is not so upright as usual, but intermediate between being nearly upright and parallel with the third longitudinal vein. This makes me doubt the identity of these specimens with this species, which is essentially a tropical one, though I have taken it as far north as Meerut. Moreover, the original description says "*alæ obscuræ nigræ*," but Wiedemann in redescribing the species says "wings blackish-brown." The wings of all the specimens I have seen alive or soon after death were obscurely black: perhaps the brown colour is due to age. The old specimens of both this and the previous species in the Indian Museum Collection, have brown wings.

Dilophus, sp. (two specimens). Theog, Phagu. Barely the size of *febrilis*, reddish-brown, with a thin dorsal thoracic stripe and

[1] The specimens from Dharampur were collected by my insect-setter.—N. A.

blackish abdomen above; black legs with coxæ and basal half of femora (anterior pair, wholly) red.

Simulium indicum Becher. One specimen from Simla is this species, whilst a second, from Phagu, appears to be an undescribed species.

Anopheles sp. (one specimen).

Culex mimeticus Noë. One example, determined by Dr. Annandale. Theog, 2nd May.

Of *Chironomidæ*, which were rather common around water tanks, at least ten species are present, amongst the males; these being distributed over twenty specimens of both sexes.

The *Tipulidæ* are represented by ten specimens of a prettily wing-marked *Trichocera* and three or four other *Limnobiinæ*, in fair condition. Also by *Pselliophora*, sp. (two specimens), Dharampur; a large handsome species which is already in the Indian Museum Collection from Nepal, Bhim Tal and Shillong. Though it is so conspicuous a species, I have been unable to identify it with any of the published descriptions.

Rhyphus fenestralis Scop. 4 ♂ ♂ 4 ♀ ♀; one from Matiana the rest from Simla. Agreeing with the European form of this common species, which occurs generally on windows; the specimens are slightly larger than usual.

Bombylius major L. 3 ♀ ♀; Matiana and Kodiali (8,400 feet). Two of the specimens (the abdomen of the third is denuded of hair) show a very faint pale dorsal line from the tip of the abdomen nearly to the base. Otherwise they agree exactly with Palæarctic specimens.

Bombylius sp. Dharampur. 1 ♂ with clear wings. The abdomen is denuded, which precludes the possibility of naming the species.

Thereva sp. Theog. 1 ♀ near the European *annulata* but differing sufficiently to make it specifically distinct.

Asilus (*sensu latu*) 3 ♂ ♂, 2 ♀ ♀; Theog and Simla. A moderate-sized grey species which might belong to any one of the considerable number of European and Oriental genera described under this genus in its widest sense. Dr. Annandale also took a ♀ of the same species at Lucknow, 21st April, 1907.

In *Empidæ*, three specimens appear to represent *Pachymeria*, *Hilara* and *Tachydromia* respectively.

Dolichopus, sp. 2 ♀ ♀; Matiana.

Pipizella; a ♂ and ♀ from Matiana probably of the same species.

Chrysogaster sp. 2 ♂ ♂; Matiana.

Melanostoma mellinum L. 2 ♂ ♂; Theog and Simla.

M. scalare F. 1 ♂; Matiana. A series of thirteen females from Simla, Theog and Matiana also appear to be the true *scalare*.

M. ambiguum Flu. 1 ♂; Matiana.

M. dubium Lett. 1 ♀ Matiana. I named this species from "Verrall's British Flies," having no European species at hand to compare it with, but it is noticeable that Verrall records it from an altitude of 3,000 feet in Scotland.

Platychirus albimanus F. 4 ♀ ♀ ; Theog and Matiana. The anterior legs are in most cases a little darker than in normal European forms, but one specimen has them almost entirely pale.

Syrphus pyrastri L. 3 ♂ ♂ 1 ♀ ; Simla and Theog.

S. balteatus De Geer 10 ♂ ♂ 3 ♀ ♀ ; Simla, Matiana, Theog.

S. torvus Ost. Sack. 2 ♂ ♂ 2 ♀ ♀ ; Matiana.

S. luniger Mg. 1 ♂ ; Theog.

S. umbellatarum F. 1 ♂ ; Matiana.

The specimens of the above five species are absolutely identical with European ones. Besides these, there are three ♂ ♂ of a species near *albostriatus* Flu., but certainly not that species—two of them are from Matiana, the other from Simla Again, there are 9 other specimens of *Syrphus* representing 6 or 7 species, which I have not yet identified.

Chilosia sp. 1 ♂ ; Matiana.

Sphærophoria sp. 6 ♂ ♂ 4 ♀ ♀ .

Eristalis tenax L. 1 ♂ 2 ♀ ♀ ; Matiana and Theog. Common everywhere, these specimens are of normal type.

Eristalis solitus Wlk. 2 ♂ ♂ 3 ♀ ♀ ; Matiana and Theog. Whether I have correctly identified the species or not I am not sure, but I have taken it commonly at Mussoorie, Darjiling, in China and Japan, while the Indian Museum Collection contains a good series from various localities in the East (Sikkim, Shillong and Mussoorie).

Rhingia sp. nov. One of each sex of a new species of this genus which I am describing in a subsequent paper on this group. A ♂ of this species exists in the Indian Museum Collection from Darjiling (7,000—12,000 feet).

In addition to the above species there is a single ♂ from Kodiali (8,400 feet) which I am unable to place generically. It is nearest to *Brachypalpus*, but lacks the enlarged posterior femora with spines beneath.

In *Tachinidæ* 13 examples represent 11 species, amongst which one is apparently a *Gonia*.

Sarcophaga is represented by 2 specimens.

In *Muscinæ veræ*, there are *Calliphora vomitoria* L. (1 ♂ 4 ♀ ♀) from Matiana and Simla ; *C. erythrocephala* Mg. (4 specimens) from Simla and Theog ; *Musca domestica* L., ♂ ♀ from Matiana and Phagu respectively.

Anthomyidæ.—I find *Homalomyia canalicularis* L. (5 ♂ ♂ ; Matiana and Theog) ; an *Aricia* (2 ♀ ♀ ; Theog) with all black legs, and a dozen other species amongst the remaining 44 specimens, mostly small *Chortophilæ*.

In *Acalypterata* I recognise the handsome *Dryomyza maculipennis* Macq. (allied to the *D. formosa* of Japan) ; one specimen having been taken at Simla. I took several of this species near a water tank on the jungly hillside at Mussoorie.

Sepedon plumbellus Wied. (Dharampur).

S. crishna Wlk. Matiana ; a male (28th to 30th April, 1907).

Of *Sepsis* three species are present, a larger one with quite clear wings (3 examples from Phagu), a smaller species with red legs, unfortunately headless (1 example from Matiana), and a third (small) species (10 examples from Matiana, Theog, Dharampur) which Dr. Annandale says is quite common in the district.

Scatophaga stercoraria L. 8 ♂ ♂ and numerous ♀ ♀, all from Simla. These show no variation from European specimens.

Amongst the remaining Acalypterata there are *Chloropinæ*, 4 spp.; *Borborinæ*, 3 or 4 spp., *Geomyzinæ* (? *Geomyza*, 3 examples of a species with 3 small spots on the wing); whilst fifty other specimens represent probably quite half that number of species.

Phoridæ.—2 specimens (1 species) of *Phora*.

MISCELLANEA.

REPTILES.

THE OCCURRENCE OF THE TAUKTE' LIZARD (*Gecko verticillatus*) IN CALCUTTA.—In Boulenger's volume on the Reptiles and Batrachians in the *Fauna of British India* the distribution of *Gecko verticillatus* is given as "Eastern Bengal to Southern China and the Malay Archipelago," while Anderson, in his account of the Reptiles of Upper Burma and Yunnan, says that it is found in the neighbourhood of Calcutta. It has taken me two years to obtain definite confirmation of the latter record by obtaining a specimen, although Rai Bahadur R. B. Sanyal, the Superintendent of the Calcutta Zoological Gardens, tells me that it is not uncommon in certain large and shady trees in these gardens, in which several specimens have recently been captured for exhibition to the public. My own specimen was taken by my assistant, Mr. C. Vaillant, in another part of the suburbs. The species differs very greatly in its habits in different localities; for while in Bangkok and in some parts of Burma it is common inside even brick dwelling-houses, in the northern part of the Malay Peninsula it is practically confined to the trunks of palm trees in the village groves, and in Calcutta it is extremely shy and wary, hiding itself in the densest foliage. In Singapore, from which several specimens are recorded, the species appears to have been introduced accidentally, probably on ships, as it does not occur in the southern part of the Malay Peninsula, and it is very possible that its occurrence in Calcutta is equally fortuitous.

N. ANNANDALE.

THE DISTRIBUTION OF *Kachuga sylhetensis*.—This tortoise appears to have been recorded hitherto only from Assam, but a specimen was brought me last winter at Rajshahi, a place situated in the new province of Eastern Bengal and Assam but lying almost due north of Calcutta. This extends the known range of *K. sylhetensis* considerably further to the west.

N. ANNANDALE.

BATRACHIA.

THE DISTRIBUTION OF *Bufo andersoni*.—This toad appears to occur over the whole of northern peninsular India as well as in Arabia, although the localities given by Boulenger, *viz.*, Agra, Rajputana and Sind, are all towards the north-west, in which it is most abundant. I recently took a specimen at Rajshahi in Eastern Bengal and there is another in the Indian Museum (quite characteristic) from Purneah. The species is very common at Lucknow, where I found numerous adults and young, many of the latter still with remnants of a tail, towards the end of April. *B. andersoni* is the only toad which I have seen from the Simla hills, in which, above 7,000 feet, the only common Batrachian appears to be *Rana vicina*; *R. breviceps*, *R. cyanophlyctis* and *R. limnocharis*, occurring at lower altitudes. I have no information how high the present species ranges, but there is a specimen labelled Simla (the town, 7,000 feet ?) in the Museum. I did not see it myself in the district, and natives of Theog (8,000 feet) told me that the only frog (or toad) they knew lived in the water.

N. ANNANDALE.

INSECTS.

NOTE ON *Rutilia nitens*, MACQ.—Seven specimens of this brilliant Dexiid (including only one ♂) in excellent condition were captured by the Museum Collector at Phularia, Nepal Terai, on May 5th, 6th and 7th, this year. The genus is the handsomest of all the Muscidæ and contains some of the largest species, eighteen of which are recorded from the Orient, but only the present one from India. It was not known hitherto from what part of India *R. nitens* came. The specimens agree almost exactly with Macquart's description. *Rutilia* is mainly an Australasian genus, but extends to some of the East Indian islands. From Victoria and Queensland I possess several splendid species of very large size, but at present I have not attempted to identify them.

E. BRUNETTI.

RECORDS OF SOME INDIAN CERAMBYCIDÆ.—The recent publication of Mr. C. J. Gahan's volume on the Cerambycidæ in the *Fauna of British India* has made it possible to identify some of the more conspicuous specimens of that family lately acquired by the Indian Museum.

The large *Acanthophorus serraticornis*, Oliv., is recorded by Mr. Gahan only from Southern India. It is, however, far more widely distributed. In the Indian Museum Collection there are specimens from Sikkim; Nowgong; Ramanad (South India); Singhbhoom Forest, Chota Nagpur, where it has been reported to be destructive to Sâl (*Shorea robusta*); and also from the Andamans. It is quite possible that this beetle may be found in any part of India and also in Burma, although there are yet no records of it from the latter country.

Neocerambyx paris, Wied., another comparatively large beetle of the same family, is by the same authority recorded from Mysore, Bangalore, Burma, Siam and Singapore. In November 1906 a characteristic specimen was obtained in Calcutta by the Museum Collector. The Indian Museum now possesses specimens from Calcutta, Maldah and Bangalore.

Lophosternus indicus, Hope, was obtained by me in May 1906 in the Purneah District. This is the only specimen yet recorded from the plains. Those recorded by Mr. Gahan are from Nepal, Bhutan and Sikkim. Similarly *Lophosternus falco*, Thoms., which I obtained in the Purneah District in May 1906, has been recorded only from Darjiling.

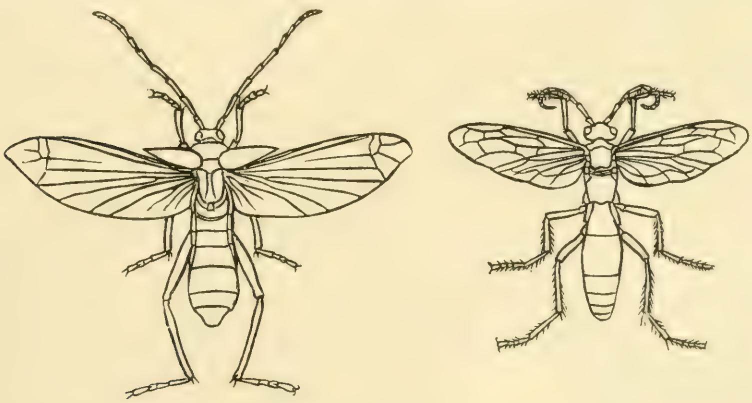
A single specimen of *Prionus elliotti*, Gahan, was obtained by Mr. E. Vredenburg of the Geological Survey of India in the Nushki District, Baluchistan, in May. The specimen recorded by Mr. Gahan is from Baluchistan, near Quetta (*C. Elliott*).

Three specimens of *Æolesthes holosericea*, Fabr., were obtained by the Museum Collector in Calcutta in January 1907. Mr. Gahan records the species from North-West India, Bombay, the Nilgiris, Ceylon, Assam, Tenasserim, the Andaman and Nicobar Islands, Siam, and the Malay Peninsula. It apparently is a very widely distributed species.

Æolesthes sarta, Solsky, has hitherto been recorded from Quetta (*E. P. Stebbing*), Turkestan and Western Tibet. The Indian Museum possesses one specimen collected by Mr. E. Vredenburg in the Nushki District, Baluchistan. In the Annual Report of the Board of Scientific Advice for India for the year 1905-06, p. 108, there is a short account, by Mr. E. P. Stebbing, of the damage done by the larvæ of this beetle to the trees forming the avenues in Quetta, where it is doubtless exceedingly common. Mr. Stebbing gives an interesting life-history of this beetle in his pamphlet entitled the "Quetta Borer." He also records it from Chagai, Chaman and Seistan.

One specimen of *Rosalia lateritia*, Hope, was presented to the Indian Museum by Mr. L. L. Fermor of the Geological Survey, who obtained it in Kumaon in October, 1906. There was only one other specimen in the Museum Collection, from Kulu. Mr. Gahan records it from the Himalayas, Travancore, Burma, Indo-China.

Another Cerambycid Beetle, *Nothopeus hemiptera*, Oliv., is worthy of note, not only on account of its distribution, but also on



Nothopeus hemiptera and *Salius madraspatanus.*

account of its close resemblance to certain other insects. It resembles the common Pompilid Hymenopteron *Salius madras-*

patanus, Smith, in a very striking manner, especially when its wings are spread out. It also resembles the boring bee *Xylocopa fenestrata* Fabr., not in form and size but in colour. Mr. Gahan records it from North India, Burma, Java. The specimen in the Indian Museum Collection was obtained in Calcutta in 1905.

C. A. PAIVA.

NOTES ON SOME INDIAN HEMIPTERA.—Dr. N. Annandale, during a recent visit to Simla, obtained one specimen of *Bagrada picta*, Fabr., at Theog, 8,000 feet, Simla hills, on the 2nd May 1907. He states that it is rather scarce in the Simla district. A few specimens were found by the collector who accompanied him, at Dharampur (5,000 feet) in the same district and month. Mr. Hodgart obtained one specimen at Nagla in the Naini Tal district in March 1907. It appears to be found all over India.

On April 28th a specimen of *Palomena reuteri*, Dist., was found by Dr. N. Annandale feeding on a Poplar tree at Matiana, 8,000 feet, Simla hills.

The only specimen now in the Indian Museum Collection of *Lelia octopunctata*, Dall., was obtained by Dr. N. Annandale at Matiana, 8,000 feet, Simla hills, on the 30th April 1907. It has been hitherto recorded from Bhutan (*British Museum*) and the Khasi Hills (*Chennell*).

One specimen of *Mictis macra*, Stål., which has hitherto been represented in the Indian Museum Collection by five specimens from Mergui, was obtained by Mr. R. Hodgart at Phularia, Nepal Terai, in May 1907. Mr. Distant, in his volume on the Rhynchota in the *Fauna of British India*, records it from Sylhet (*Stockholm Museum*) and mentions that it is also found in the Malay Peninsula. It appears to be rather rare in India.

In March 1907 quite a number of specimens of *Clavigralla gibbosa*, Spin., were brought to the Museum by the Museum Collector. This species seems to abound on a plant which Mr. I. H. Burkill has identified as the composite herb *Blumea wightiana*, DC. *Clavigralla gibbosa* is recorded by Mr. Distant from Bombay (*Distant Collection*); Bangalore (*Cameron*); Tenasserim, Myitta (*Doherty*). Mr. R. Hodgart collected a specimen at Bijaura, Nepal Terai, in May 1907. It is apparently widely distributed.

Several specimens of *Lygæus equestris*, Linn., from Murree, Punjab, are in the Museum Collection. Dr. N. Annandale found it very common on bare and grassy hillsides in the Simla district, above 7,000 feet. It is very active on the wing. The specimens obtained by Dr. Annandale are from Theog, 8,000 feet (27th April 1907), and Matiana, 8,000 feet (28th April 1907).

Macropes dilutus, Dist., was hitherto unrepresented in the Indian Museum Collection, but in January 1907 Mr. R. Hodgart obtained three specimens at Bijnor, United Provinces. This appears to be the only definite locality in India proper from which the species has yet been recorded. Mr. Distant records it from "North India" (*Distant Collection*); Burma: Bhamo (*Fea*).

In February 1907 the Museum Collector obtained a young specimen of the Giant Cotton Bug, *Lohita grandis*, Gray, with a seed-like object, about the size of an ordinary pea, attached to its rostrum; and although the insect received a good deal of handling, the object remained suspended to the rostrum. Mr. I. H. Burkill,

Young *Lohita grandis* sucking seed of *Ipomœa*.

of the Industrial Section of the Indian Museum, identified the seed as that of a species of Ipomœa. Its shell is very hard; no impression can be made on it with an ordinary knife, and it appears wonderful how such a small insect could have thrust its proboscis into the seed. On careful examination of several seeds of the same kind, I found, on one side of the seed, a very small raised spot, with a slight depression in the centre. This is the only penetrable part in the seed and is doubtless the part the bug chooses for the insertion of its proboscis.

A few specimens of *Dermatinus lugubris*, Dist., were collected by Mr. R. Hodgart at Bareilly, United Provinces, and at Songara, Gonda district, in March 1907. Hitherto there was only one specimen of this species in the Museum Collection, from Chatrapur, Ganjam district. Madras and Pondicherry are the only localities recorded by Mr. Distant.

One specimen of *Gerbilius ornatus*, Dist., was obtained by Mr. R. Hodgart at Nagla, Naini Tal district, in March 1907. This is the only specimen now in the Museum Collection. Mr. Distant records it from Bor Ghat (*Dixon*) and Ceylon (*Green*).

Vesbius purpureus, Thunb., is recorded by Mr. Distant from Assam, Khasi Hills (*Distant Collection*); Ceylon (*Green*); Burma: Bhamo (*Fea*); Java; Philippines. On the 3rd March 1907 the Museum Collector obtained one specimen in Calcutta. There are two others in the Museum Collection, one from Calcutta and the other from Margherita, Upper Assam.

Specimens of *Salda dixoni*, Dist., were found to be very common at Theog, 8,000 feet, Simla hills, at the beginning of May 1907, by Dr. N. Annandale, who states that they are abundant there at the edge of a pond, and are very active, jumping about and taking to the wing readily, but never flying far. They are able to run and leap on the surface of the water. Mr. Distant considered this species rare, as he says in his volume on the Rhynchota in the *Fauna of British India*, that he had seen but two specimens, one sent him by Mr. R. M. Dixon from Bor Ghat, Bombay, and another collected by Signor Fea at Rangoon.

C. A. PAIVA.

CRUSTACEA.

A PREOCCUPIED SPECIFIC NAME IN *Macrothrix*.—In reference to a species described in his recent paper (*Rec. Ind. Mus.*, I, p. 25, June, 1907) on Indian Freshwater Entomostraca, Mr. R. Gurney writes under date June 7th, 1907, as follows: "I find that I have used in my last paper a name already used, *viz. Macrothrix tenuicornis*. Kurz used it many years ago for *M. rosea*. If possible, will you change the name of my species to *Macrothrix odiosa*." Unfortunately the letter arrived after the paper had been issued, but *Macrothrix odiosa* should stand as a correction.

MOLLUSCA.

AN ENEMY OF CERTAIN PEARL OYSTERS IN THE PERSIAN GULF.—A number of specimens of Pearl Oysters from the Persian Gulf have recently been sent to the Indian Museum for identification; they belong to the three species mentioned by Evans in the *Proc. Roy. Phys. Soc. Edinburgh* for 1892, namely, *Avicula macroptera* (local name *zanni*), *Meleagrina vulgaris* (local name *muhar*), and *M. margaritifera* (local name *sadifi*), the last representing Jamieson's var. *persica*. Nearly all the shells of *A. macroptera* and a few of those of *M. margaritifera* had been injured by the burrows of a mussel, which Mr. H. B. Preston has identified as *Lithodomus malaccanus*, Reeve. The burrows in the shells were not vertical, but nearly horizontal; they were cylindrical, rounded at the end and not much longer than the mussel. Their diameter was, however, sufficiently great to have injured the inner layers of the pearl shell in many instances and to have caused the deposit of irregular masses of dark nacre on the internal surface. The outer layer was generally more or less broken above the burrows and in such places had almost invariably been attacked by the boring sponge *Clione*. The mussel itself had in some cases been attacked by another borer, which had made comparatively large circular holes in one of its valves. *Lithodomus malaccanus* is not mentioned by Herdman among the enemies of the Ceylon Pearl Oyster, although it is known to occur in the Gulf of Manaar; it is recorded doubtfully by Melvill in his list of the shells of the Persian Gulf.

N. ANNANDALE.

THE DISTRIBUTION IN INDIA OF THE AFRICAN SNAIL *Achatina fulica*, FÉR.—It is well known that this gigantic snail, introduced from Mauritius, is common in the gardens of Calcutta and the neighbourhood. As it is said to be spreading to other parts of India, I should be very glad of specimens from any part of the country not in the immediate neighbourhood of Calcutta. The species is easily recognized by its large conical shell, which measures about $4\frac{1}{2}$ inches in length and is marked with more or less confused longitudinal chocolate stripes.

N. ANNANDALE.

POLYZOA.

STATOBLASTS FROM THE SURFACE OF A HIMALAYAN POND.—During a recent visit (in April and May) to the Simla district in the Western Himalayas I made a careful examination of the surface of all ponds, wells and streams I came across, in the hope of finding floating sponge gemmules or polyzoon statoblasts. So much dust is blown up from the plains of the Punjab into the hills that I rather expected to find these bodies on the water, even if the organisms which produce them did not occur. In almost every case but one, however, my search was fruitless, although at first sight I took for gemmules certain bodies which were probably the egg-shells of the Phyllopod Crustacean *Branchinecta orientalis*, Sars. On the horse-pond at Theog, a village situated at an altitude of 8,000 feet about seventeen miles beyond the town of Simla, I found in a scum of animal and vegetable débris numerous statoblasts agreeing in every respect with those of the typical *Plumatella emarginata*, and although I was unable to find living colonies of this animal, it is possible that they existed on certain stones near the centre of the pond that I was unable to reach. Together with the statoblasts were certain other bodies which may be those of some unknown species. Each contained two brownish capsules, which were approximately circular in outline and were enclosed in a mass of air-cells. One edge of the whole structure was straight while the other was curved. I know of no species to which they can belong. Similar bodies were also found on the surface of a small pond above the village of Phagu, at a point about five hundred feet higher than Theog and five miles nearer Simla.

N. ANNANDALE.

NOTES ON *Hislopia lacustris*, CARTER.—Through the kindness of Dr. N. Annandale, I have recently had the opportunity of comparing a specimen of *Hislopia lacustris* from Calcutta with the same species as it occurs in the United Provinces at Bulandshahr. Dr. Annandale has so fully described this Polyzoon as met with in Calcutta (*Journ. Asiat. Soc. Bengal*, vol. ii, No. 3, March 1906, and *id.*, vol. iii, No. 2, February 1907), that I shall content myself with pointing out in what respects specimens from the United Provinces of India differ from those found, some 700 miles further east, at Calcutta.

Dr. Annandale's observations were made in January and February (*i.e.*, in the "cold weather") at Calcutta, and mine were made in April and May (*i.e.*, at the beginning of the "hot weather") at Bulandshahr; but Dr. Annandale tells me that he has recently examined specimens taken in Calcutta in June and that they do not differ from those taken in February in the same tank.

In Calcutta the species has only been found on the leaves of *Valisneria spiralis.*

In describing the form of the colonies, Dr. Annandale says that, in Calcutta " the linear arrangement is far commoner than any other, but occasionally several zoœcia are adjacent to one another in a transverse series." A somewhat similar arrangement to this " linear " one also occurs at Bulandshahr, though it is much rarer than that next to be described. I have found a few small colonies, of perhaps twenty to thirty zoœcia growing in this way on slender submerged leaves and twigs, where the colony has not room to extend much laterally. But in this part of India (the United Provinces) *Hislopia* is far more frequently found in the form of a flattened encrusting sheath on the outer surface of the shells of *Paludina* and at least one other freshwater Gastropod. This was the condition described originally by Carter (*Ann. Mag. Nat. Hist.* (3), i, page 169).

The colony consists of a single layer of zoœcia, and completely covers the whole surface of the shell with the exception of the narrow surface which lies in contact with the upper part of the protruded " foot " of the Mollusc. Almost every *Paludina* that I have examined carries *Hislopia* about with it, and as *Paludina* occurs very abundantly, *Hislopia* is by far the commonest of the Polyzoa met with in this part of India.

The zoœcium of the encrusting form is of a darker brown colour than the other; in both varieties the colour is most marked at the margin of the orifice.

Carter describes the shape of the zoœcium as " irregularly ovate." This oval shape is decidedly more marked in the encrusting than in the linear form. The orifice always occurs nearer the broad than the narrow end of the oval, and projects further above the surface of the zoœcium in the encrusting form. Very few of my specimens show spines at the orifice, and those that do bear spines have them in a more or less rudimentary condition. As this occurs in large zoœcia, which contain eggs, I cannot think that the absence of spinesiis a sign of immaturity.

I fully agree with Dr. Annandale's remarks about the nature of the " valves," and my observations do not confirm the statement made by Carter (quoted by Annandale, *loc. cit.*) that the posterior " valve " is larger than the others.

As noticed by Carter and Dr. Annandale, the " collar " is a very conspicuous part of the polypide.

Although when reduced to writing, the differences between the two forms of *Hislopia* do not appear to be very great, I think that if only the dried colonies were available for examination, there would be a strong tendency to regard them as distinct species at least. But the living polypides appear to be identical in form, and there is little doubt that the two quite distinct phases in which *Hislopia* occurs are merely another example of that variability which is well known to occur in other Polyzoa, such as *Plumatella.*

H. J. WALTON, *Capt., I.M.S.*

XIII.—REPORT ON THE MARINE POLYZOA IN THE COLLECTION OF THE INDIAN MUSEUM.

By LAURA R. THORNELY.

INTRODUCTION.

The Polyzoa here described are derived from various sources, chiefly from the collections made by the Indian Marine Survey (R.I.M.S. "Investigator"), the late Mr. J. Wood-Mason, the late Dr. J. Anderson, and a few private donors. With the exception of a small number of specimens from Gaspar Straits and the Straits of Malacca, the whole of the material is from Indian seas.

The following is a list of the "Investigator" stations from which specimens are recorded:—

	Lat. N.	Long. E.	
Station No. 58 ..	16° 30′	72°	15 fathoms.
,, ,, 59 ..	6° 6′ 30″	81° 23′	32 ,,
,, ,, 61 ..	14° 54′ 30″	93° 51′	41 ,,
,, ,, 77 ..	Off Ganjam Coast 13 miles E.S.E. Barwa ..		35 ,,
,, ,, 79 ..	Off Ganjam Coast 10 miles E.S.E. Kawita ..		33 ,,
,, ,, 90 ..	Off Ganjam Coast 8 miles E.S.E. Kalingapatam		28-30 ,,
,, ,, 148 ..	....	....	15-30 ,,
,, ,, 197 ..	9° 26′ 30″	75° 36′ 30″	406 ,,
,, ,, 255 ..	9° 26′ 30″	91° 56′ 30″	869-913 ,,
,, ,, 327 ..	17° 7′ 30″	94° 5′ 30″	419 ,,
,, ,, 331 ..	11° 46′ 30″	93° 16′	569 ,,
,, ,, 333 ..	6° 31′	79° 38′ 45″	401 ,,
,, ,, 346 ..	26° 37′ 30″	53° 3′ 30″	47 ,,

There are 81 species represented, four of which (a *Scrupocellaria*, a *Canda*, and two species of *Mucronella*) I consider new to science, while the following twenty-four are new to Indian waters: *Ætea recta*, *Caberea lata*, *Bugula ditrupæ*, *Synnotum aviculare*, *Flustra* *dentigera*, *F. rhizophora*, *F. pisciformis*, *Carbasea cribriformis*, *Cellaria tenuirostris*, *Membranipora tenuirostris*, *M. tuberculata*, *M. radicifera*, *Thalamoporella smittii*, *Microporella malusii*, *Lagenipora socialis*, *Schizoporella tenuis*, *Smittia marmorea*, *Mucronella canalifera*, *Retepora producta*, *R. monilifera*, *Adeonella platalea*, *A. distoma*, *Cellepora cylindriformis*, *Bowerbankia caudata*. Many of these species have been found in Australian waters.

Two species (*Bifaxaria* ? and *Reteporella* ?) are doubtful; while twenty-one have been already found in Indian seas. Of the latter, four were included in a list of fourteen species collected by Mr. Thurston in the Gulf of Manaar and described (*Madras Gov. Mus. Bull*, No. 3, 1905) by Mr. Kirkpatrick; six were in the late Dr. J. Anderson's Mergui collection, named by Hincks in 1887 (*Journ. Linn. Soc. Zool.*, vol. xxi); six were identified by Hincks in a list of various collections from India, Singapore and Ceylon, recorded by him in his "Contribution towards a General History of the Marine Polyzoa" in the *Ann. Mag. Nat. Hist.*, series 5, vol. vi, and subsequent volumes; while one, *Membranipora bengalensis*, was described by the late Dr. F. Stoliczka in the *Journ. Asiat. Soc. Bengal*, part 2, vol. xxxviii, p. 55, 1869. All these species, with the exception of the last and of *Thalamoporella smittii*, were recorded by me, with thirty-eight others, in my report on the Polyzoa collected by Professor Herdman off the coast of Ceylon in 1902 (Suppl. Report XXVI to Herdman's *Ceylon Pearl Oyster Fisheries*, pt. iv).

Order ECTOPROCTA.

Sub-order CHEILOSTOMATA.

Family ÆTEIDÆ.

1. *Ætea recta*, Hincks.

Ann. Mag. Nat. Hist., series 3, vol. ix, p. 25, 1862.
Locality.—Andamans, growing on *Tubucellaria cereoides*.

Family CATENARIADÆ.

2. *Catenaria lafontii*, Aud.

Localities.—Ye, Burma; Marshall Channel, Andamans; Stations 59 and 77, Indian Marine Survey.

Family CELLULARIADÆ.

3. *Scrupocellaria scrupea*, Busk.

Ann. Mag. Nat. Hist., series 2, vol. vii, p. 83, 1851.
Locality.—Off Mangalore, 26-31 fathoms (Indian Marine Survey).

4. *Scrupocellaria cervicornis,* Busk.

Brit. Mus. Cat. Mar. Pol., pt. i, page 24.
Locality.—Pedro Shoal, 25 fathoms (Wood-Mason).

There is very little of this lovely species, but the glassy texture, the antler-like spines and the tracery on the fornix, also the perforated oœcia, are all beautifully represented.

5. *Scrupocellaria diadema,* Busk.

Brit. Mus. Cat. Mar. Pol., pt. i, p. 24.
Localities.—Off Cheduba, 28-30 fathoms (Armstrong); Station 90, Indian Marine Survey.

6. *Scrupocellaria gaspari,* sp. nov.

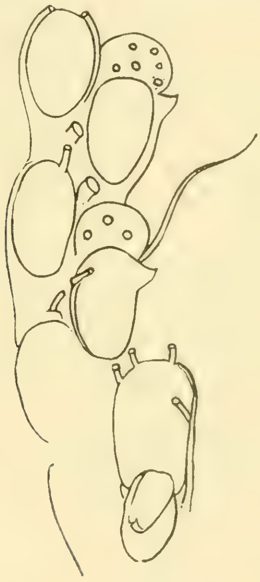


FIG. 1.—*Scrupocellaria gaspari,* sp. nov.

Zoœcium with oral aperture occupying two-thirds of its front wall, having a thick, smooth margin and four spines above. The open space below the aperture is narrowed downwards, supporting on one side a small, raised avicularium pointing outwards. This avicularium is replaced by a very large one on each of those zoœcia situated next below the fork of a branch. Lateral avicularia, small vibraculæ, no fornix. Oœcia perforated. Radical tubes serrated.

The present species resembles *S. ferox*, Busk (*Brit. Mus. Cat. Mar. Pol.*, pt. i) in the small lateral avicularia and the serrated radical tubes, but in *S. ferox* each zoœcium has a large avicularium below the aperture, while here they are small except on the zoœcia situated below the fork of a branch. Also, the zoœcia are armed, while those of *S. ferox* are unarmed.

Localities.—Gaspar Straits, Malay Archipelago; Andamans; Stations 59, 77, 90, Indian Marine Survey.

7. *Canda retiformis*, Pourtalès.

(Caberia retiformis) Smitt, "Floridan Bryozoa," pt. i, p. 16, in *Vetensk. Akad. Handl.*, vol. xi, 1872.

Localities.—Off Ceylon Coast, 32-34 fathoms; Andamans, 20-30 fathoms (Indian Marine Survey); Ye, Burma; Stations 59, 77, 148, Indian Marine Survey.

8. *Canda pecten*, sp. nov.

FIG. 2.—*Canda pecten*, sp. nov.

Zoœcia oval, elongated, with thin, raised margin and a spine, rarely two, on either side above. Membranous area reaching half way down the front wall, a thin, calcareous, diagonal sheet covering the rest, no fornix or medium avicularium, except an enormous avicularium at the base of each fork of a branch which is raised on a large prominence, having frilled edges, and is long, narrow and pointed, directed downwards and inwards. Grooves of the vibracular reach beyond the edge of the zoœcia, behind. The junction of the connecting fibres is seen below these, and there are serrated rootlets near the bases of the colonies as in *Scrupocellaria ferox* and *S. macandrei.* Oœcia lie back on the median line of the stem, one above the other, alternately, from their positions rather to one side of the top of the zoœcia to which they belong. They have a rounded, membranous portion in front and a sort of umbo, sometimes, above.

Localities.—Coast of Cheduba, 28-30 fathoms (Armstrong); Station 61, Indian Marine Survey.

9. *Caberea lata*, Busk.

Brit. Mus. Cat. Mar. Pol., pt. i, p. 39.
Locality.—Gaspar Straits (J. S. Gardner)

Family BICELLARIIDÆ.

10. *Diplœcium simplex*, Kirkpatrick.

Ann. Mag. Nat. Hist., series 6, vol. i, p. 73, 1888.
Locality—Off Passage Island, Andamans, 17 fathoms.

11. *Bugula ditrupæ*, Busk.

Quart. Journ. Micro. Sci., old series, vol. vi, p. 261, 1858.
Locality.—Andamans, 35 fathoms.

12. *Bugula neritina*, Linn.

These specimens have avicularia as in those mentioned in my report on the Polyzoa from Ceylon (Suppl. Report XXVI to Herdman's *Ceylon Pearl Oyster Fisheries*, pt. iv).
Locality.—Ye, Burma (Indian Marine Survey).

13. *Bugula sinuosa*, Busk.

Voy. H.M.S. "Challenger," pt. xxx (vol. x), p. 39
Localities.—Eight miles S.E. of Cinque Island, 500 fathoms; Andamans, 780 fathoms.

Family NOTAMIIDÆ.

14. *Synnotum aviculare*, Pieper.

Hincks, *Ann. Mag. Nat. Hist.*, series 5, vol. xvii, p. 257, 1886.
Localities.—Marshall Channel, Andamans; Stations 59, 77, Indian Marine Survey.

Family FLUSTRIDÆ.

15. *Flustra dentigera*, Hincks.

Ann. Mag. Nat. Hist., series 5, vol. ix, p. 116, 1882.

A beautiful fan-shaped colony half an inch high by one and a quarter inches wide. Unfortunately no oœcia are present.
Locality.—Andamans (Wood-Mason).

16. *Flustra rhizophora*, Ortman.

Die Japanische Bryozoen Fauna.

As in Ortman's description, there are no internal or lateral denticles. There are two, rarely four, spines above. Avicularia have the long, pointed mandibles which lie along one side of the zoœcia, beneath which is the area they originate from. Oœcia with the usual calcareous bar across the front are present. There are only a few fragmentary tips of branches of this species; they resemble the palmate form of *F. foliacea*, measuring three-fourths of an inch across.

Locality.—Off Mangalore, 26-31 fathoms (Indian Marine Survey).

17. *Flustra pisciformis*, Busk.

(Carbasea pisciformis) *Brit. Mus. Cat. Mar. Pol.*, pt. i, p. 50.

This small colony agrees with Busk's description of the zoœcia and oœcia but has an occasional avicularium which has the same form as that of *F. securifrons*; the zoœcia are larger, however, than those of the British *F. securifrons*, and the species is altogether more like the description of *F. pisciformis*.

18. *Diachoris intermedia*, Hincks.

Ann. Mag. Nat. Hist., series 5, vol. viii, p. 133, 1881.

Localities.—Stations 59, 77, Indian Marine Survey.

19. *Carbasea cribriformis*, Busk.

Voy. H.M.S. "Challenger," pt. xxx (vol. x), p. 58.

There are only a few fragments of this species in the collection, so that the spiral growth at the bases of fenestra cannot be seen; otherwise the characters agree with Busk's description.

Localities.—Stations 59, 61, 77, (72, 15, 34 fathoms,) Indian Marine Survey.

Family CELLARIIDÆ.

20. *Cellaria tenuirostris*, Busk.

(Salicornaria tenuirostris) *Brit. Mus. Cat. Mar. Pol.*, pt. i, p. 17.

There is only one specimen of this form, measuring about one inch in height and being well branched. Avicularia have shorter mandibles mentioned by Busk (*Voy. H.M.S. "Challenger,"* pt. xxx (vol. x), p. 92). The internodes are swollen with the number of oœcia present, and the opening to these, above the orifice is oval with a spade-shaped operculum. The knots of radical tubes, alluded to by Smitt ("Floridan Bryozoa," pt. ii, p. 4, in *Vetensk. Akad. Handl.*, vol. xi, 1872), are to be seen where each branch is given off.

21. *Nellia oculata*, Busk.

Brit. Mus. Cat. Mar. Pol., pt. i, p. 18.
Localities—Gaspar Straits; Stations 59, 77, 90, Indian Marine Survey; Andamans (Wood-Mason).

Family TUBUCELLARIIDÆ.

22. *Tubucellaria cereoides*, Ellis and Sol.

MacGillivray, *Trans. Roy. Soc. Vict.*, vol. xxi, p. 107, 1884.
Localities.—Off Table Island, Andamans (Indian Marine Survey); Andamans, 130-250 fathoms; west coast Andamans (Wood-Mason).

Family MEMBRANIPORIDÆ.

23. *Membranipora tenuirostris*, Hincks.

Ann. Mag. Nat. Hist., series 5, vol. vi, p. 70, 1880.
Locality.—Lat. 6° 1′ N., Long. 81° 16′ E., 34 fathoms (Indian Marine Survey); Andamans (Wood-Mason).

24. *Membranipora tuberculata*, Busk.

Quart. Journ. Micro. Sci., old series, vol. vi, p. 126, 1858.

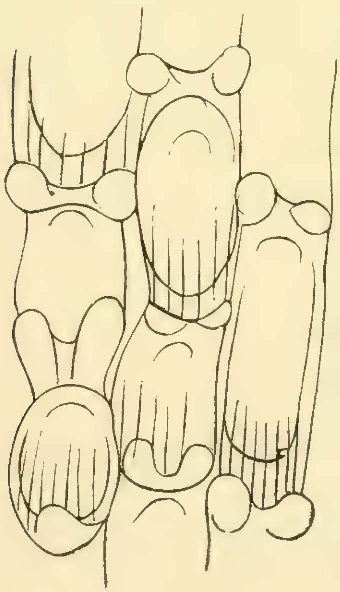


FIG. 3.—*Membranipora tuberculata*, Busk.

There is a point that makes me hesitate in considering this species to be *M. tuberculata*. The blunt tubercles are hollowed in a cave-like manner on the side nearest the basis of the zoœcia, and the membrane of the front wall of the zoœcium can be sometimes seen extending below the aperture, over the margin, which has become widened and attached to the tubercles above the hollowed portions. These tubercles with age become united to form a transversely elongated tubercle, as described by Busk for *M. tuberculata*. This species should probably be called *Amphiblestrum* instead of *Membranipora*.

Locality.—Station 327, Indian Marine Survey.

25. *Membranipora bengalensis,* Stoliczka.

Journ. Asiat. Soc. Bengal, vol. xxxviii, pt. 2, p. 55, 1869.

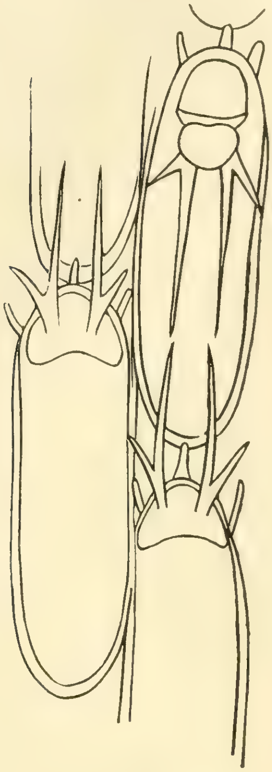


FIG. 4.—*Membranipora bengalensis,* Stol.

The spines described by Stoliczka as proceeding downwards from the lower lip are in these specimens situated on the operculum; they appear as if proceeding from the lower lip when the operculum is open, but stand upright when it is closed. There are no lateral spines present on these specimens, but on either side of the usual basal spine there is one not mentioned in the original description.

Locality.—Snod Island.

26. *Membranipora radicifera* var. *intermedia,* Kirkpatrick.

Proc. Roy. Dub. Soc., vol. vi, new series, p. 615, 1890.

Locality.—Cheduba, 6 fathoms.

27. *Membranipora coronata,* Hincks.

Ann. Mag. Nat. Hist., series 5, vol. vii, p. 147, 1881.

Localities.—Lat. 6° 1′ N., Long. 81° 16′ E., 34 fathoms; off Port Blair, 100 fathoms (Indian Marine Survey); Marshall Channel, Andamans (Indian Marine Survey).

28. *Membranipora delicatula,* Busk.

Hincks, *Ann. Mag. Nat. Hist.,* series 5, vol. vi, p. 86, 1880.

A small colony closely adhering to a stick.

Locality.—Off Mangalore, 26-31 fathoms.

Family MICROPORIDÆ.

29. *Steganoporella simplex,* Harmer.

Quart. Journ. Micro. Sci., vol. xliii, p. 253, 1900.

Locality.—Lat. 6° 1′ N., Long. 81° 16′ E., 34 fathoms (Indian Marine Survey).

30. *Steganoporella sulcata,* Harmer.

Quart. Journ. Micro. Sci., vol. xliii, p. 246, 1900.

Locality.—Off Table Island, Andamans (Indian Marine Survey).

31. *Thalamoporella smittii*, Hincks.

Journ. Linn. Soc., vol. xxi p. 123, 1889.
Locality—Pedro Shoal, 25 fathoms.

32. *Bifaxaria* ? sp.

FIG. 5.—*Bifaxaria* ? sp.

A fragment, measuring half an inch in height, probably belonging to this genus, has a continuous, branched, calcareous zoarium, composed of zoœcia united back to back, divisions between them very indistinctly seen. Orifice rounded with a loop-shaped sinus deeply sunk, but its primary form continuous up to the surface of the zoarium. A few, scattered, rounded avicularia round the margins of the zoœcia.
Locality.—Lat. 5° 56′ N., Long. 91° 05′ E., 1,590 fathoms (Wood-Mason).

33. *Cribrilina radiata*, Moll.

Localities.—Lat. 6° 1′ N., Long. 81° 16′ E., 34 fathoms; coast of Cheduba, 28-30 fathoms (Armstrong); Cheduba, 6 fathoms; Station 90, Indian Marine Survey.

Family MICROPORELLIDÆ.

34. *Microporella ciliata*, Pallas.

These specimens have the wing-like modification of the avicularia mentioned by Hincks (*Ann. Mag. Nat. Hist.*, vol. ix, p. 24, 1882) as having been found by Captain Cawne Warren on the coast of Ceylon.
Localities.—Stations 59 and 77, Indian Marine Survey.

35. *Microporella violacea* form *plagiopora*, John.

Hincks, *Brit. Marine Pol.*, vol. i, p. 216.
Locality.—Cheduba, 6 fathoms.

36. *Microporella malusii*, Aud.

Locality.—Lat. 6° 1′ N., Long. 81° 16′ E., 34 fathoms (Indian Marine Survey).

37. *Chorizopora brongniartii*, Aud.

Localities.—Lat. 6° 1′ N., Long. 81° 16′ E., 34 fathoms; Cheduba, 6 fathoms.

Family PORINIDÆ.

38. *Lagenipora spinulosa*, Hincks.
Ann. Mag. Nat. Hist., series 5, vol. xiii, pp. 57 and 210, 1884.
Locality.—Andamans (Wood-Mason).

39. *Lagenipora socialis*, Hincks.

Ann. Mag. Nat. Hist., series 4, vol. xx, p. 215, 1877.

The colonies of this species are in the form of little caps which appear to have encrusted some round body and from which they are broken off. The zoœcia radiate from a hole in the centre which is occupied in some cases by the stem of a branching red coral. The tubular orifice of the zoœcium has often spinous processes behind. The specimens differ from Hinck's description in having a roughened instead of a smooth wall to the oœcia, and in having perforations scattered over the whole front wall of the zoœcium.
Locality.—Andamans.

40. *Lagenipora tuberculata*, MacGil.

McCoy, *Prodromus Zool. Vict.*, decade xvi, vol. ii, p. 209.
Locality.—Lat. 6° 1′ N., Long. 81° 16′ E. (Indian Marine Survey).

Family MONOPORELLIDÆ.

41. *Monoporella albicans*, Hincks.

Ann. Mag. Nat. Hist., series 5, vol. ix, p. 123, 1882.

There is a purplish tinge to these colonies, caused by the dark colour of the operculæ as in *Cellepora albirostris* (Smitt "Floridan Bryozoa," pt. ii, p. 70, in *Vetensk. Akad. Handl.*, vol. xi, 1872).
Locality.—Marshall Channel, Andamans (Indian Marine Survey).

42. *Monoporella lepida*, Hincks.

(Haploporella lepida) *Ann. Mag. Nat. Hist.*, series 5, vol. viii, p. 11, 1881.
Locality.—Lat. 6° 1′ N., Long. 81° 16′ E., 34 fathoms (Indian Marine Survey).

Family Myriozoidæ.

43. *Schizoporella tenuis*, Busk.

Voy. H.M.S. "Challenger," pt. xxx (vol. x), p. 165.

The present specimens must be much finer colonies than those described by Busk. The zoarium is free, forming hollow tubular branches which expand into funnel-shaped ends whose sides sometimes fall in, forming various convolutions, and as growth proceeds the branches meet and unite so as to make a confused, interlaced colony. These colonies are of very delicate texture and pearly white in early stages of growth, becoming more substantial and of a shiny, pinkish colour with age. Oœcia are present very large, each nearly covering the zoœcium above the one to which it belongs. The orifices of fertile zoœcia are about twice as large as those of ordinary zoœcia.

Localities.—Off Passage Island, Andamans, 17 fathoms; Marshall Strait, Table Island.

44. *Schizoporella nivea*, Busk.

Voy. H.M.S. "Challenger," pt. xxx (vol. x), p. 163.

Locality.—Andamans (Wood-Mason).

45. *Schizoporella aperta*, Hincks.

Ann. Mag. Nat. Hist., series 5, vol. ix, p. 126, 1882.

These specimens correspond with those brought by Professor Herdman from Ceylon and recorded by me (in Suppl. Report XXVI to Herdman's *Ceylon Pearl Oyster Fisheries*, pt. iv). They have two spines on the upper margin of the orifice not mentioned by Busk. Oœcia are present here, not in the Ceylon collection. The beaks of the large avicularia are not serrated as described by Hincks (*Ann. Mag. Nat. Hist.*, series 5, vol. ix).

Localities.—Coast of Cheduba, 28-30 fathoms (Armstrong); 8 miles E.S.E. Kalingapatam, 28-30 fathoms.

46. *Schizoporella spongitis*, Pallas.

Locality.—Pedro Shoal, 25 fathoms.

47. *Schizoporella incrassata*, Hincks.

Ann. Mag. Nat. Hist., series 5, vol. ix, p. 124, 1882.

The frontal, large avicularia have on this specimen forked mandibles instead of pointed. Other characters correspond with Hincks' description, but there are no oœcia to help in the identification of the species.

Locality.—Off Ceylon coast, 32-34 fathoms (Indian Marine Survey).

48. *Schizoporella cecilii*, Aud.

Hincks, *Brit. Marine Pol.*, vol. i, p. 269.

Locality.—Pedro Shoal, 25 fathoms.

49. *Rhyncozoon incisor*, Thornely.

Suppl. Report XXVI to Herdman's *Ceylon Pearl Oyster Fisheries*, pt. iv.
Locality.—Lat. 6° 1′ N., Long. 81° 16′ E., 34 fathoms (Indian Marine Survey).

50. *Gemellipora glabra* form *striatula*, Smitt.

"Floridan Bryozoa," pt. ii, p. 37, in *Vetensk. Akad. Handl.*, vol. xi, 1872.
Locality.—Cheduba, 6 fathoms.

Family ESCHARIDÆ.

51. *Lepralia cucullata*, Busk.

Brit. Mus. Cat. Mar. Pol., pt. ii, p. 81.
Localities.—Galle (Dr. J. Anderson); Cheduba, 6 fathoms.

52. *Lepralia fuegensis*, Busk.

(Eschara fuegensis) *Brit. Mus. Cat. Mar. Pol.*, pt. ii, p. 90.
Locality.—Marshall Channel, Andamans (Indian Marine Survey).

53. *Lepralia adpressa*, Busk.

Brit. Mus. Cat. Mar. Pol., pt. ii, p. 82.
Locality.—Lat. 6° 1′ N., Long. 81° 16′ E., 34 fathoms (Indian Marine Survey).

54. *Lepralia multidentata*, Thornely.

Suppl. Report XXVI to Herdman's *Ceylon Pearl Oyster Fisheries*, pt. iv, p. 120.
Locality.—Lat. 6° 1′ N., Long. 81° 16′ E., 34 fathoms (Indian Marine Survey).

55. *Lepralia turrita*, Smitt.

"Floridan Bryozoa," pt. ii, p. 65, in *Vetensk. Akad. Handl.*, vol. xi, 1872.
Locality.—Station 58, Indian Marine Survey

56. *Lepralia poissonii*, Aud.

Hincks, *Ann. Mag. Nat. Hist.*, series 5, vol. viii, p. 122, 1881.
Locality.—Andamans, 120 fathoms (Indian Marine Survey).

57. *Porella malleolus*, Hincks.

Ann. Mag. Nat. Hist., series 5 vol. xiii, p. 361, 1884.
Locality.—Pedro Shoal, 25 fathoms.

58. *Smittia marmorea*, Hincks.

Brit. Marine Pol., vol. i, p. 350.
Locality.—Coast of Cheduba, 28-30 fathoms (Armstrong).

59. *Smittia rostriformis*, Kirkpatrick.

Ann. Mag. Nat. Hist., series 6, vol. i, p. 80, 1888.
Locality.—Station 90, Indian Marine Survey.

60. *Smittia trispinosa*, Johnston.

Several varieties of this species.
Localities.—Kilakarai, Gulf of Manaar (Annandale); Station 90, Indian Marine Survey.

61. *Mucronella canalifera*, Busk.

Waters, *Voy. H.M.S. "Challenger,"* pt. lxxix (vol. xxxi), p. 24.

I have some hesitation in considering the present specimen to be *M. canalifera*. It has the characteristic features of upright zoœcia, with finely punctured surface, semiorbicular orifice, without a tooth, spines above and at the sides of the orifice, and a spout-like lower lip. This last is, however, not so prominent as in Busk's figure, the spines usually number four, sometimes five, but not six, and are jointed at their bases; also there are, here and there, large pointed avicularia not described by Busk. No oœcia are present.
Locality.—Marshall Channel, Andamans (Indian Marine Survey).

62. *Mucronella tubulosa*, Hincks.

Ann. Mag. Nat. Hist., series 5, vol. vi, p. 383, 1880.
Locality.—Marshall Channel, Andamans (Indian Marine Survey).

63. *Mucronella formidabilis*, sp. nov.

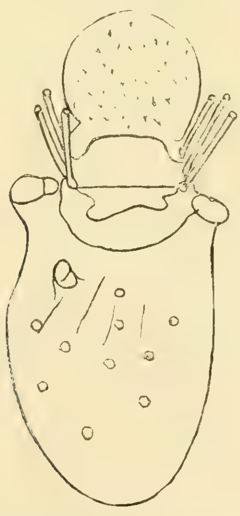


FIG. 6.—*Mucronella formidabilis*, sp. nov.

Zoarium incrusting, of a light brown colour. Zoœcia large, deeply divided, rising from the base to the orifice, coarsely and regularly punctured. Orifice large, arched above, contracted near the base, with a point there on either side below the hinge of the operculum. Six to eight large, jointed spines above, six of which show in front of the oœcium when present. Peristome rising below the orifice into a swollen hollow process with an avicularium on its inner aspect lying horizontally and having a tongue-shaped mandible. Numerous protuberances bearing small, rounded avicularia scattered over the front wall of the zoœcium and round the margin of the orifice, sometimes reduced to two or three only. Oœcia finely punctured, their sides prolonged downwards, leaving a square opening.

Locality.—N. Sentinel bearing N. 15 miles, W. 18 miles, 250 fathoms ; growing on the cast spine of a sea-urchin.

There are resemblances between this species and *Mucronella vultur* and *M. aviculifera*, but there is the great distinction here of no internal denticle to the orifice.

64. *Mucronella maculata*, sp. nov.

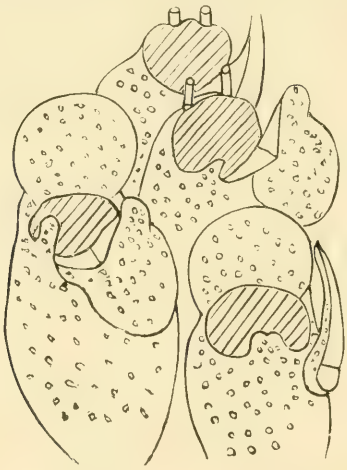


FIG. 7.—*Mucronella maculata*, sp. nov.

Zoarium incrusting, loosely attached to sea weed. Zoœcia large, distinct, deeply divided. Surface finely granulated. Orifice rounded above, narrowing gradually to a point below, usually two spines above, a large mucro below, either in the centre or to one side according to the form of a prominence bearing an avicularium which is usually large and rounded, with a horizontally placed avicularium and occupying a large space rather to one side of the centre of the orifice pushing the mucro to one side ; it is sometimes, however, produced into a narrow, curved process which stands straight up on one side of the orifice, the avicularium long and pointing upwards. There is sometimes a second similar avicularium on the other side of the orifice. When this form of avicularium is present the mucro holds its central position. A third form of avicularium is borne on a spout-like protuberance of the front wall of the zoœcium, and is an addition, not a substitute for the others. Oœcia are large and rounded and granulated, like the walls of the zoœcia.

Locality.—Pedro Shoal, 25 fathoms

65. *Retepora tubulata*, Busk.

Voy. H.M S. " Challenger," pt. xxx (vol. x), p. 121.

In the " Challenger " report, one distinction given between this species and *R. philippinensis* is that the celluliferous surface of the zoarium is in the latter outside, instead of inside the tubular alveolæ. In the present specimen the first wide, vase-shaped fold of the zoarium has the celluliferous surface on its inside aspect, but the tubular branches, rising from this, have the celluliferous surface on their outside surface. Oœcia are plentiful and the forked avicularia is present at the bases of many of the fenestræ.

Localities.—Gaspar Straits (J. S. Gardner) ; Stations 59, 77, Indian Marine Survey ; southern portion of Malacca Straits (S.S. " Sherard Osborne").

66. *Retepora producta*, Busk.

Voy. H.M.S. " Challenger," pt. xxx (vol. x), p. 108.

Locality.—Pedro Shoal, 25 fathoms.

67. *Retepora monilifera*, MacGil.

Trans. Roy. Soc. Vict., vol. xx, p. 105, 1883.

A fragment, which corresponds generally with MacGillivray's species, as described in McCoy's *Prod. Zool. Vict.*, vol. i, decade x, p. 19, has three very marked features. 1. The enormous avicularia, ending in sharp points, which are placed in front and at the bases of most fenestræ of the zoarium. They pass right through the opening, and the rostrum has a tooth on either side of where the point of the mandible rests. 2. The very prominent oœcia which stand up almost at right angles to the orifice of the zoœcia and end in a point, formed by the tip of the vertical portion of the beaded band on the front wall of the oœcium. 3. The large, raised avicularia with short, curved mandibles present on the front wall of some zoœcia. Of these features the long pointed avicularia agree with MacGillivray's form *Munita*, except that they are situated at the bases of, not above, fenestræ. In the forward bend of the vertical beaded line on the oœcia, there is a resemblance to form *Sinuata*. There appears to be no absolute agreement with any one form mentioned.

Locality.—Station 148, Indian Marine Survey.

68. *Retepora pocillum*, Thornely.

Suppl. Report XXVI to Herdman's *Ceylon Pearl Oyster Fisheries*, pt. iv, p. 125.

Localities.—Off the coast of Ceylon, 32-34 fathoms (Indian Marine Survey); Lat. 6° 1′ N., Long. 81° 16′ E., 34 fathoms (Indian Marine Survey).

69. *Reteporella* ? sp.

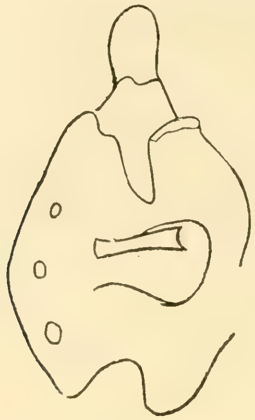


FIG. 8.—*Reteporella* ? sp.

Zoarium branched, surface glistening, zoœcia smooth, with large pores here and there round the margin. The front wall rising from the base upwards to rather prominent shoulder-like projections on either side of the orifice. Primary orifice with two teeth near the base, sometimes meeting and leaving a pore below them. Secondary orifice with a much raised peristome, cleft in front. A large avicularium ending in two points, raised on an eminence and lying across the front of some zoœcia.

Locality.—Off west coast, Andamans, 290-238 fathoms (Carpenter).

There is a general resemblance between this species and Smitt's ("Floridan Bryozoa," pt. ii, p. 67) *Retepora marsupiata*, but the fragment in the present collection indicates a branched, possibly a reticulate zoarium but not fenestrated, and the characters of the primary orifice and of the avicularia do not agree with those of that species.

Family ADEONIDÆ.

70. *Adeonella subsulcata*, Smitt.

(Porina subsulcata) "Floridan Bryozoa," pt. ii, p. 28, in *Vetensk. Akad. Handl.*, vol. xi, 1872.

Localities.—Off Sentinel Island (?), 13 fathoms; Marshall Channel, Andamans (Indian Marine Survey).

71. *Adeonella platalea*, Busk.

Voy. H.M.S. "Challenger," pt. xxx (vol. x), p. 184.

Localities.—Ye, Burma coast; Gregory Island (Indian Marine Survey).

72. *Adeonella distoma*, Busk.

(Lepralia distoma) *Quart. Journ. Micro. Sci.*, old series, vol. vi, p. 127, 1858.

The present specimens are old, with thick calcareous walls the perforated area much sunk. There are more pores in some zooecia than are described by Busk, and here and there on a separate area below the zooecia there is a small avicularium, pointing downwards.

Locality.—Station 61, Indian Marine Surve

Family CELLEPORIDÆ.

73. *Cellepora cylindriformis*, Busk.

Voy. H.M.S. "Challenger," pt. xxx (vol. x), p. 201.

The base of this specimen has evidently incrusted some cylindrical object. It has all the characters described by Busk, but is a much larger colony, rising free and branched to the height of half an inch.

Locality.—Andamans, 130-25 fathoms (Indian Marine Survey).

74. *Cellepora megasoma*, MacGil

(Lepralia megasoma) McCoy, *Prod. Zool. Vict.*, decade iv, vol. i, p. 33.

Localities.—Stations 59, 79, 90, Indian Marine Survey; Pedro Shoal, 25 fathoms.

75. *Cellepora cidaris*, MacGil

McCoy, *Prod. Zool. Vict.*, decade xvii, vol. ii, p. 245

There are large colonies of what I believe to be this form, although they have solid instead of hollow columnar processes as described by MacGillivray

Localities—Off Ceylon coast, 32-34 fathoms (Indian Marine Survey); off Port Blair, 100 fathoms (Indian Marine Survey); Lat. 6° 1′ N., Long. 81° 16′ E. (Indian Marine Survey); Stations 59, 77, Indian Marine Survey.

Sub-Order CYCLOSTOMATA.

Family CRISIIDÆ.

76. *Crisia holdsworthii*, Busk.

Brit. Mus. Cat. Mar. Pol., pt. iii, p. 7.

Localities.—Off Ceylon coast, 32-34 fathoms (Indian Marine Survey); Lat. 6° 1 N., Long. 81° 16′ E., 34 fathoms (Indian Marine Survey).

77. *Idmonea milneana*, d'Orb.

Locality.—Station 148, Indian Marine Survey.

Sub-Order CTENOSTOMATA.

Family VESICULARIIDÆ.

78. *Amathia distans*, Busk.

Voy. H.M.S. "Challenger," Pt. L (vol. xvii), p. 33.
Localities.—Coast of Cheduba, 28-30 fathoms (Armstrong); Andamans (Wood-Mason).

79. *Bowerbankia caudata*, Hincks.

(Valkeria caudata) *Ann. Mag. Nat. Hist.*, series 4, vol. xx, p. 215, 1877.
Locality.—Port Canning, Ganges Delta, incrusting bricks in brackish pool (Annandale).

80. *Farrella atlantica*, Busk.

Voy. H.M.S. "Challenger," Pt. L (vol. xvii), p. 37.
Locality.—Ye, Burma (Indian Marine Survey).

Family CYLINDRŒCIIDÆ

81. *Cylindrœcium dilatatum*, Hincks.

Brit. Marine Pol., vol. i, p. 536.

These specimens have large, spinous dilatations at their bases, as described by Hincks for some of his specimens.
Locality.—Mangalore, 26-31 fathoms (Indian Marine Survey).

XIV.—THE FAUNA OF BRACKISH PONDS AT PORT CANNING, LOWER BENGAL.

PART VI.—OBSERVATIONS ON THE POLYZOA, WITH FURTHER NOTES ON THE PONDS.

By N. ANNANDALE, *D.Sc., Officiating Superintendent, Indian Museum.*

Thanks to the kindness of Mr. D. Hooper, I am now able to give figures representing approximately the maximum and minimum salinity of the water of one of the ponds during the present year. A sample taken on May 25th (about three weeks before the beginning of the rainy season) from the pond in which the hydroid of *Irene ceylonensis* was found, contained 22·88 per thousand of saline residue, while one taken from the neighbourhood of the same pond on July 9th contained only 9·82 per thousand. At the latter date the whole area containing the ponds was flooded and the river embankment had broken down in their vicinity. It will be remembered that the water of the same pond contained 12·13 per thousand of saline constituents in December, and 20·22 per thousand in March. By an unfortunate mistake the former figure is misquoted as 0·22 per cent. on pp. 69 and 82 of pt. i of these "Records."

A factor in the distribution of the pond fauna to which attention was not paid in my preliminary account (pp. 35—43) is the bore on the Matla river. Mr. Hodgart, Zoological Collector in the Museum, tells me that at this time of year it is often so strong that people in the neighbourhood of breaks in the embankment are obliged to take refuge on its approach in the upper storey of the nearest brick house. The bore of course only affects the ponds when the embankment is broken and they are therefore put in communication with the river, but on such occasions it must bring into them many organisms from the neighbourhood of the open sea. Collections made in the ponds during the present month (July, 1907) include specimens of several forms not hitherto taken in the tanks, notably one of a species of the Sipunculid genus *Physcosoma*, which was found in the mud. They also include most of the forms already taken, notably *Metridium schillerianum* var. *exul* in great abundance and the Polyzoa *Victorella pavida* and *Bowerbankia caudata*, both in interesting stages; *Irene ceylonensis* was not seen.

POLYZOA.

Numerous statoblasts of *Plumatella* were found floating on the surface of the ponds in July, together with gemmules of *Spongilla alba*; but as a very careful search failed to reveal living colonies of Phylactolæmatous Polyzoa at any season in the ponds, it is probable that the statoblasts had been brought from freshwater tanks in the vicinity by wind or by flood. The only Polyzoa taken recently in the ponds in an active condition are Ctenostomes, *viz.*, *Victorella pavida* and *Bowerbankia caudata*; but the type specimens of *Membranipora bengalensis*, which are still in the Indian Museum, were collected from brackish ponds in the neighbourhood by the late Dr. Stoliczka thirty-nine years ago. Miss L. Thornely (*Rec. Ind. Mus.*, i, p. 186) has recently examined specimens from Mergui, and I have nothing to add to her report, which is published in this number of the *Records of the Indian Museum*, except to say that I have been unable to identify in Stoliczka's types the "statoblasts" to which he refers (*Journ. Asiat. Soc. Bengal* (2), 1869, p. 58). It seems probable from his figures and description that what he saw were polypides in different stages of development from brown bodies, together with unripe gonads. In some species the gonads are well developed, after the formation of a brown body, while the new polypide is still in a very rudimentary condition.

Family PALUDICELLIDÆ.

Ctenostomes that die down in unfavourable conditions after the production of resting buds, which differ in form from the zoœcia and are enclosed in an impermeable substance resembling chitin. Zoœcia tubular, arising either directly from another zoœcia, or from tubular outgrowths from the sides of other zoœcia, or from a false stolon. The false stolon consists of tubular prolongations of the base of each zoœcium, neither the false stolon nor the tubular outgrowths being always present. Funiculus well developed; gizzard feebly muscular.

I follow Jullien (*Bull. Zool. Soc. France*, x, p. 174, 1885) in regarding *Paludicella* Gervais as the type of a family, to which, in my opinion, *Victorella* and, if it be generically distinct, *Potsiella* also belong. I have, however, given a new definition of this family, in order to lay stress on the feature that seems to me most important, *viz.*, the production of the so-called hibernacula in unfavourable conditions. The term hibernacula is, however, misleading, for the structures it is intended to describe are formed in India in summer and spring. They do not appear to have been hitherto described in the case of *Victorella*, as the "winter buds" that several authors have noted in this genus are buds very much like the ordinary zoœcia. As regards the position of *Paludicella* and its allies, if they are to be regarded as a distinct family, they are intermediate between the Stolonifera and the astoloniferous families of the Ctenostomes. As I have already indicated, their " stolon " is not a true stolon in the sense that the " rhizome " of a form such as *Bowerbankia* is one. It is not always distinguishable, and when it is definitely present is not sepa-

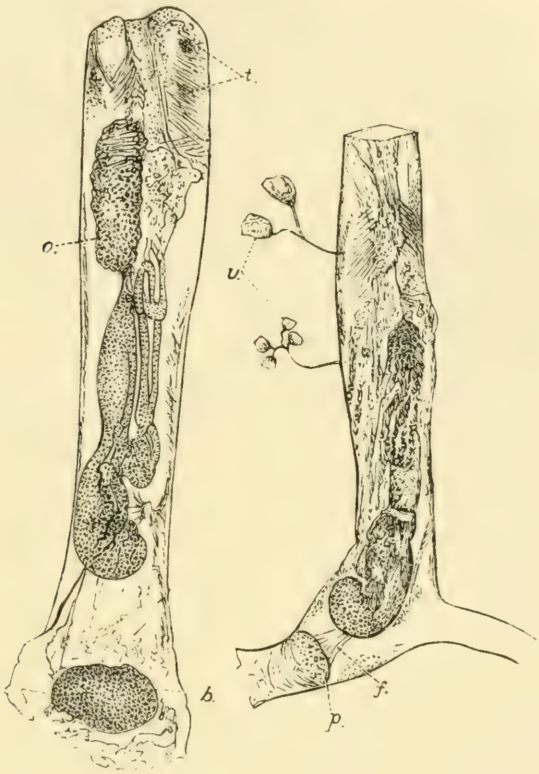


FIG. 1. FIG. 2.

FIGS. 1 AND 2.—Zoœcia of *Victorella pavida* from Port Canning at the end of winter, × 70. (From preserved specimens)

b = young resting bud ; f funiculus; o = ovary ; p = plate separating the zoœcia ; t = testes ; v = vorticellids growing on the zoœcia.

rated off from the cavities in which the polypides rest, but consists of prolongations of the base of the zoœcia, the separating plate occurring in the false stolon at some little distance from the base of the polypide (fig. 2). This is really what is meant by the statement of several authors that in *Victorella* the zoœcia arise from swellings in a creeping stolon ; it would be more accurate to say that the creeping stolon consisted of the base of the zoœcia produced in two or four directions. A rudiment of just such a false stolon is sometimes found in *Hislopia* (the type of another family of freshwater Ctenostomes) and apparently occurs in a fully developed condition in the Arachnidiidæ. The family most closely allied to the Paludicellidæ is probably the Cylindrœciidæ, to which Pennington (in Bousfield, *op. post. cit.*, p. 406) thought that *Victorella* belonged.

The Paludicellidæ occur all over the world, but only in fresh and brackish water, in which they are exposed to the dangers of desiccation and violent changes of temperature. It is noteworthy, however, that the only other genus of Ctenostomes that occurs in fresh water in the Oriental Region, namely *Hislopia*, appears not to form resting buds and is capable of sexual reproduction at all times of year. This genus constitutes, according to Jullien, the type of a second family and appears to be sufficiently different from all other forms to merit this distinction. The family Hislopiidæ may be defined as follows :—

Perennial freshwater Ctenostomes in which the zoœcia are flat and recumbent and arise directly from other zoœcia in linear or ramifying series. The front of the zoœcium membranous, the sides and the rim of the aperture (which is more or less raised and tubular) thickened. Funiculus practically absent; gizzard furnished with thickened ridges internally.

The examination of numerous specimens of *Hislopia lacustris* from Calcutta, the United Provinces of Agra and Oudh,[1] and the Malay Peninsula convinces me that Jullien's *Norodonia sinensis* and *N. cambodgiensis* are merely phases or varieties of this species, which must therefore be widely distributed in the East. The form of the zoœcia and the method of budding would suggest a relationship with the Arachnidiidæ. Although *Hislopia* is not found in brackish water, the foregoing description and notes may be of use in distinguishing it from the Paludicellidæ.

Victorella pavida, Kent.

(V. pavida), Kent, *Quart. Journ. Micr. Sci.*, x, p. 34, 1870; Hincks, *Brit. Marine Polyzoa*, p. 559, pl. 79; Bousfield, *Ann. Mag. Nat. Hist.* (5), xvi, p. 401, 1885; Kraepelin, *Deutsch. Süssw. Bryozoen* (part i), p. 95, 1887.

It is unnecessary to give a formal description of this species, the anatomy of which has been described by Bousfield (*op. cit.*). Indian specimens agree fairly well with the descriptions of English ones, being readily distinguished from those of any other Ctenostome by their mode of budding. Possibly there are slight differences between the Bengal and the British races, but it is difficult to be sure that such differences are constant without examining a large number of examples from different localities, and this I have had no opportunity of doing. Bousfield refers to specimens he found in England in spring as having zoœcia that were " solitary, and semi-reptant, colourless, and in shape much like a violin with a straight elongated neck" ; but he describes specimens he took in the same locality in the month of September in the following terms : " The polypidom consists of slender yellow or brownish tubes, on which at intervals are situated swellings . . . . in each of which

[1] See also Walton in *Rec. Ind. Mus.*, i, p. 177, 1907.

a zoid is developed . . . . From each swelling arise two branches at right angles, and by the growth of these branches and the development of zoœcia, from which again other branches arise, the growth of the colony continues, always branching in a rectangular direction, so that a matted mass results."

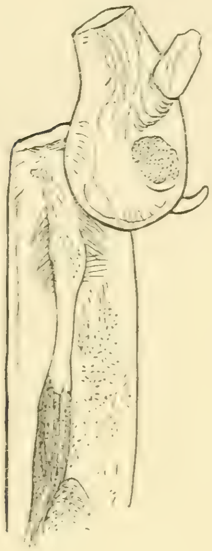


FIG. 3.

FIG. 4.

FIG. 3.—Distal extremity of zoœcium of *V. pavida* from Port Canning, with bud, ×70. (From preserved specimens.)

FIG 4.—Resting buds (*b*) of *V. pavida*, with remains of zoœcium, × 70: Port Canning, July, 1907. (From preserved specimens.)

In the neighbourhood of Calcutta I have found specimens corresponding with both of the phases thus described. Specimens (fig. 1) obtained in winter from the ponds at Port Canning, represented a phase similar to that found in September in England, except that the whole of the zoarium was practically colourless. Many of the zoœcia bore lateral buds, which were situated in most cases near the distal extremity. From these buds (fig. 3) originated tubular outgrowths, which, in a few cases, gave rise to other zoœcia. I did not find, however, examples that could be compared in complexity with that figured by Kraepelin on plate iii, fig. 75, of the work referred to under his name. The buds in my specimens were, moreover, less distinctly cylindrical than those he describes, being shorter and more gradually rounded at the base. They were only produced on a relatively small number of zoœcia.

Other specimens, taken earlier in the season in a canal, the water of which was only slightly brackish, at Dhappa near Calcutta, had the zoœcia partially recumbent and of the same form as those of the specimens taken by Bousfield in England in spring. The zoœcia were, however, closely packed together (the false stolon between them being very short) and in a few cases bore buds near the distal extremity. In these specimens, although the aperture was in most cases distinctly rectangular, it was occasionally almost circular. Kraepelin (*op. cit.*, p. 158, footnote) has described under the name *Paludicella mülleri*, a somewhat similar form, which he regards as intermediate between *Paludicella* and *Victorella*; but this form is stated never to produce buds on the distal part of the zoœcia, always to have this region circular in cross-section, and to possess a circular musculature.

Both the specimens from Dhappa and those from Port Canning that were taken in winter, bore ripe gonads, the testes and ovaries reaching maturity simultaneously in the same zoœcia. The ovary (fig. 1) consisted of a single mass, elongated in a vertical direction and situated on the inner wall of the zoœcium some little distance below the aperture. The testes, on the other hand, occurred as a number of small rounded bodies scattered over the greater part of the zoœcium, but particularly numerous near its distal extremity.

At the base of the zoœcia (fig. 1) of several colonies obtained from Dhappa and Port Canning during winter, small, mound-shaped masses of densely granular cells of a brownish colour were observed occasionally, taking the place of basal buds in the zoarium. In a few cases, in specimens taken both in November and January, these masses appeared to have secreted a thin chitinous investment, which was not, however, very distinct at the edges. In specimens taken in the ponds at Port Canning in July, shortly after the beginning of the rainy season, "resting buds" (fig. 4) were observed in the same position, and there could be no doubt that they represented a more perfect stage in the development of the same structures. The resting buds (fig. 4) were flattened, more or less oblong bodies of very variable size and outline, the upper surface being slightly arched and bearing a number of longitudinal ridges, which occasionally ramified; the sides were produced into several tubular projections, on which the chitinous coat was comparatively thin. The colour of the whole structure was dark brown. As a rule two resting buds were present at the base of each zoœcium that produced them, but sometimes there was only one and occasionally there were three; only a comparatively small number of zoœcia had produced them. Such zoœcia, and the majority of the others, contained at this season no polypides, but were either empty or contained brown bodies. Frequently even empty zoœcia retained their external form, except that the aperture was tightly closed and the adjacent region circular in cross-section, and in many cases the collar persisted as a wrinkled and pleated funnel-shaped membrane extended from the distal extremity of the zoœcium. A few polypides were active, some of them being long, thin and very transparent, while others were short and relatively stout; the latter occurring chiefly towards the periphery of the zoarium and being semi-recumbent. In a few cases it appeared that the long thin polypides had recently developed from resting buds at the base of dead zooecia, but none were found actually in the course of development. No sexually mature zooecia were observed.

The form of the resting buds of *Victorella pavida* is not without a certain systematic interest, for not only do they appear to exhibit very distinct differences from those of *Paludicella* and *Potsiella*, but their shape is not altogether dissimilar to that of the zooecia of *Hislopia*. It is possible, judging from the analogy of other organisms found in stagnant water in Lower Bengal, that they are produced both at the end of autumn and the beginning of spring, both these seasons being critical periods in the life cycles of many of the lower invertebrates of the Calcutta tanks. If this is so, it is probable that they do not undergo further development in the one case until the cold weather is well established, and in the other until the rains have lowered the temperature very considerably. The dangers to be guarded against at the two periods are different. In spring the approach of the hot weather not only raises the temperature of the water but also, perhaps consequently, induces an enormous multiplication of aquatic bacteria. Whether these bacteria have any specific action on other organisms is not known, but their rapid increase is accompanied by a simultaneous disappearance or depauperation of many of the common aquatic invertebrates, while the scum they produce on the surface certainly prevents aëration of the water. In autumn, on the other hand, the risk of actual desiccation is great, for although evaporation is naturally more pronounced in summer, it is, at this season, to some extent counterbalanced by the heavy thundershowers that frequently fall; whereas in winter, during which there is usually very little rain, the temperature is quite high enough to evaporate the water of many of the smaller pools.

Family VESICULARIIDÆ.

The characters of this family have been discussed by all those who have dealt from a systematic point of view with the Ctenostomes as a whole, but the tropical species are still far from being well known. So far as they have been studied, they appear to be closely related to, or in many cases identical with European forms. In the East, as in Europe, members of certain genera are not averse to brackish water. It is worthy of note that *Victorella pavida* was originally found in England in the same locality as *Bowerbankia imbricata*, a species allied to the one found with it in Lower Bengal.

Bowerbankia caudata, Hincks.

(B. caudata) Hincks, *Brit. Marine Polyzoa*, p. 521, pl. 75.

I am indebted in the first instance for the identification of this species to Miss L. Thornely. Mr. R. Kirkpatrick has also been kind enough to examine specimens and is of the opinion that they are identical with Hincks's species. A renewed search in the ponds has proved it to be at least as abundant as *Victorella pavida*, the two species frequently occurring together on the same stem or root and their zoaria being very closely interlocked. *B. caudata* is, however, generally more restricted as to the area it covers than *V. pavida*, which as a rule surrounds it when the two are found in close contact. In such circumstances it is by no means easy, distinct as the species really are, to distinguish one from the other. The bases of the zoaria are almost invariably concealed by a dense growth of minute algæ and other organisms, and, except when buds are being produced on the zoœcia by *Victorella*, the distal ends of the zoœcia are extraordinarily alike. The basal portion of these structures, when it is visible or if it can be freed from external matter, affords the best means of diagnosis. The nature of this part of the organism has already been fully dealt with in the case of one species; in the other, *B. caudata*, the zoœcia adhere to the sides of the stolon and end in each case in a free conical "tail," which as a rule hangs down beneath the level of the stolon. This character is often to some extent obscured in old individuals, although very clear in some zoœcia of every zoarium.

If the polypides are alive and can be induced to expand their lophophores while under observation, the readiest way to distinguish *Victorella* from *Bowerbankia* is to note that whereas the gizzard is highly muscular in the latter, its walls are thin in the former. In living examples of the two forms this character is conspicuous when the tentacles are extruded, and can be detected with a little care even when they are retracted; but in preserved material it is often difficult to be sure as regards the nature of the gizzard, which is clearly present (as Bousfield noticed) even in *Victorella*.

My specimens of *B. caudata* agree fairly well with Hincks's figures, but the "tail" of the zoœcia is sometimes longer and occasionally forks at its free extremity, the alternate arrangement of the zoœcia is not quite constant, and the stolon is divided by partitions placed at irregular intervals. When the zoarium becomes much matted together, the "tails" appear to grow longer than is the case when the colony has plenty of room for expansion, and sometimes secondary adhesions are formed both between the "tail" and another loop of the stolon and between different parts of the stolon. When the tails adhere to the stolon in this way they do so either by their sides or by their tips.

The tentacles, which always number eight, bear at their base a long sensory bristle (which slopes backwards and downwards when the lophophore is expanded) and a series of three or four approximately horizontal, finer hairs on their external surface, as well as a bunch of still finer hairs at their tip.

Specimens taken during winter were sexually mature, the gonads closely resembling those of *Victorella*. In most cases, however, the testes became mature before the ovaries. Colonies kept through the hot weather in an aquarium in which the salinity of the water was maintained at an even level, continued to produce spermatozoa until the end of June and did not form brown bodies. I failed to observe the formation of ovaries in these circumstances. It is evident, however, that in the ponds the polypides cease to be active and produce brown bodies during the hot weather. In colonies taken from their natural habitat in July, during the floods referred to at the beginning of this paper, only a few zoœcia were active, and these few appeared from their transparency to have recently been rejuvenated. In the majority of the zoœcia new polypides were in the course of development from brown bodies, the tentacles in most cases being already visible as short digitate processes. On the walls of zoœcia containing tentacles in this stage of rejuvenescence the gonads were already almost mature, both ovaries and testes being already far advanced and occurring together.

An interesting observation, possibly connecting the formation of brown bodies with that of the resting buds of the Paludicellidæ, was made as regards some of these zoœcia, namely that their walls were greatly thickened and had a brownish or greenish colour not due to the presence of minute organisms. Other zoœcia, however, in which the polypides were in exactly the same condition, resembled the empty zoœcia of *Victorella* at the same time of the year, having thin walls and the collar protruding from their distal extremity.

XV.—A THIRD NOTE[1] ON EARWIGS (*DERMAPTERA*) IN THE INDIAN MUSEUM, WITH THE DESCRIPTION OF A NEW SPECIES.

By MALCOLM BURR, *B.A., F.Z.S., F.G.S., F.L.S., F.E.S.*

Genus DIPLATYS, Serville.

1. *siva* Burr. Bhim Tal, Kumaon, 4,500 feet, 19th to 22nd September 1906, "feeding on flowers of stinging nettles." Three larvæ, which I refer with some doubt to this species. Nos. $\frac{623}{15}$, $\frac{625}{15}$ and $\frac{728}{15}$ (N. Annandale).
2. *gladiator* Burr. Calcutta, 22nd November 1906, ♀, No. $\frac{1248}{15}$ (J. Caunter).

Genus FORCIPULA, Bolivar.

1. *trispinosa* Dohrn. Nepal; Chitlong, Nos. $\frac{751}{15}$ and $\frac{752}{15}$, ♂ ♂; $\frac{746}{15}$ and $\frac{750}{15}$, ♀ ♀ (R. Hodgart); Pharping, No. $\frac{1241}{15}$, ♀; $\frac{1243}{15}$, ♂ (R. Hodgart). Calcutta, "at light," No. $\frac{594}{15}$, ♂, and $\frac{595}{15}$, ♀ (C. A. Paiva). Also the following larvæ and immature specimens are probably to be referred to this species: Bhim Tal, Kumaon, 4,500 feet, 19th to 22nd September 1906, No. $\frac{624}{15}$ (N. Annandale). Nepal; Pharping, Nos. $\frac{1240}{15}$ and $\frac{1244}{15}$ (R. Hodgart). Nepal; Soondrijal, October 1906, Nos. $\frac{1270}{15}$, $\frac{1271}{15}$, $\frac{1273}{15}$, $\frac{1276}{15}$, $\frac{1277}{15}$, $\frac{1278}{15}$, $\frac{1280}{15}$, $\frac{1281}{15}$, ♀ ♀; $\frac{1291}{15}$ to $\frac{1295}{15}$, very small and ill-developed ♂ ♂; $\frac{1288}{15}$, $\frac{1289}{15}$ and $\frac{1297}{15}$, larvæ (R. Hodgart).
2. *decolyi* Borm. Nepal; Soondrijal, Nos. $\frac{1272}{15}$ and $\frac{1274}{15}$, ♂ ♂ (R. Hodgart).

Genus LABIDURA, Leach.

1. *bengalensis* Dohrn. Siliguri, N. Bengal, No. $\frac{602}{15}$, ♀. Chandpur, District of Tipperah, No. $\frac{597}{15}$, 10th September 1906, ♀ (I. H. Burkill).
2. *riparia* Pall. Kathgodam, U.P., 3rd October 1906, No. $\frac{1246}{15}$, one larva (N. Annandale). Comilla, Bengal, two larvæ (Lefroy). Pusa (Lefroy[2]). Var. *inermis*, Pusa, ♂ ♂ (Lefroy).

---

[1] The two previous papers on the collection were published in the *Journ. Asiatic Soc. Bengal*, 1905, p. 27; and 1906, p. 387.

[2] This and other specimens recorded as collected by Lefroy belong to the collection of the Imperial Entomologist, Pusa.—ED.

3. *nepalensis* sp. n.

Parva, gracilis; pronotum angustum, longius quam latus, postice rotundatum; elytra granulosa, carina exteriori distincta, acuta; alæ longæ; pedes testacei, fusco-annulati; abdomen cylindricum, læve; segmentum ultimum ♂ rectangulare; pygidium ♂ ♀ haud perspicuum; forcipis bracchia ♂ basi triquetra, margine interno per tertiam partem longitudinis fortiter laminato-dilatato, hac parte dente terminata; dehinc valde attenuata, gracilia, inermia, incurva.

		♂	♀
Long.	corporis ..	7·5—9·75 mm.	8·5—11 mm.
,,	forcipis ..	3	1·75—2

STATURE small and slender.

COLOUR dull black; last dorsal segment and forceps reddish black; antennæ greyish; feet testaceous, femora and tibiæ banded with blackish.

ANTENNÆ typical of genus; 21 segments.

HEAD smooth and convex; sutures obsolete.

PRONOTUM somewhat longer than broad, anterior border straight, posterior border rounded; prozona somewhat tumid; metazona flattened.

ELYTRA long, truncate, granulated, carina sharp and well defined; dull black.

WINGS long, same texture as elytra.

FEET slender, typical.

STERNUM brown, typical.

ABDOMEN dull chocolate black, with a pale sparse pubescence, which is denser and longer in the ♀; apparently smooth, exceedingly finely punctulated; no lateral tubercles.

VENTER dark brown, smooth, with fine yellowish pubescence.

PENULTIMATE VENTRAL SEGMENT ♂ obtusangular, truncate apically; ♀ rounded.

LAST VENTRAL SEGMENT almost hidden in both sexes, only the exterior angles visible.

LAST DORSAL SEGMENT: ♂ rectangular, reddish black, with a longitudinal median sulcus, and a blunt tubercle on each side at posterior border; ♀, attenuate, with median depression.

PYGIDIUM ♂ ♀ not apparent.

FORCEPS with the branches of the ♂ triquetre and stout at the base; inner margin depressed into a sharp flattened plate along one-third of its length; this part terminated with a small sharp tooth; the edges contiguous; then strongly attenuate, unarmed, gently incurved; on the underside each branch is deeply furrowed. In the ♀, simple, straight, conical.

HAB.—Nepal; Soondrijal, $\frac{1283=88,\ 93,\ 98,\ 99}{15}$, 3 ♂ ♂, 6 ♀ ♀; Pharping, $\frac{1245}{15}$, ♂ (Indian Museum, R. Hodgart).

Falls into the group of *L. lividipes* and *L. tenuicornis*, characterised by small size and slender build; this is a species at once distinguished by the dilated forceps, recalling typical *Forficula*.

4. *lividipes* Duf. Chakradharpur, Chota Nagpur, No. $\frac{9520}{14}$, ♀, 3rd to 6th March 1906 (N. Annandale). Siliguri, North Bengal, No. $\frac{600}{15}$, ♀; Calcutta, No. $\frac{599}{15}$ (C. A. Paiva).

Genus ANISOLABIS, Fieber.

1. *annulipes* Luc. Calcutta, 24th August 1906, No. $\frac{598}{15}$, ♂ (C. A. Paiva). Pusa (Lefroy).
2. *annandalei*. Comilla, E. Bengal, Nos. $\frac{303}{15}$ and $\frac{306}{15}$, ♀ ♀; Dacca, E. Bengal, Nos. $\frac{354}{15}$ and $\frac{355}{15}$, ♀ ♀.

These specimens are much redder than the type, which is probably bleached; the head and feet are uniform deep red.

Genus LABIA, Leach.

1. sp. (?).

This is probably a new species; there is a single female from Bhim Tal, Kumaon, at 4,500 feet, 19th to 22nd September 1906 (N. Annandale).

Genus CHELISOCHES, Scudder.

1. *melanocephalus* Dohrn. Pusa (Lefroy) ♂; Barisal, E. Bengal, ♀ (Lefroy); Munshiganj, Bengal (Lefroy).
2. *simulans* Stål. Pusa (Lefroy), ♀, Calcutta; "at light," 14th November 1906 (N. Annandale).

Genus ANECHURA, Scudder.

1. *feæ* Borm. Nepal; Chitlong, Nos. $\frac{734}{15}$ to $\frac{748}{15}$, 7 ♂ ♂, 8 ♀ ♀ (R. Hodgart). Naini Tal, Kumaon, 6,400 feet, 1st October 1906, No. $\frac{601}{15}$, ♂; $\frac{604}{15}$, ♀ (N. Annandale).
2. *metallica* Dohrn. Bhim Tal, 4,500 feet, Kumaon, 19th to 22nd September 1906, "feeding on flowers of stinging nettles," Nos. $\frac{616}{15}$ and $\frac{629}{15}$, ♀ ♀ (N. Annandale). Nepal; Soondrijal, Nos. $\frac{1275}{15}$, ♂; and $\frac{1279}{15}$, ♀; Gowchar, Nos. $\frac{1300}{15}$, ♂; $\frac{1301}{15}$, ♀ (R. Hodgart); Nagorkoti, No. $\frac{1303}{15}$, ♀ (R. Hodgart).

Genus ALLODAHLIA, Verhœff.

1. *coriacea* Borm. Bhim Tal, 4,500 feet, Kumaon, "feeding on flowers of stinging nettles," 19th to 22nd September 1906, Nos. $\frac{605}{15}$, $\frac{606}{15}$, $\frac{610}{15}$, ♀ ♀; $\frac{613}{15}$, $\frac{615}{15}$, $\frac{618}{15}$, $\frac{619}{15}$, $\frac{611}{15}$, $\frac{622}{15}$, $\frac{630}{15}$, ♂ ♂ and ♀ ♀ (N. Annandale).
2. *ancylura* Dohrn. Bhim Tal, 4,500 feet, Kumaon, "feeding on flowers of stinging nettles," 19th to 22nd September 1906, No. $\frac{617}{15}$, ♂ (N. Annandale).

Genus APTERYGIDA, Westwood.

1. *bipartita* Kirb. var. *macrolabia*. Mussoorie, United Provinces, (Lefroy).
2 *arachides* Yers Bombay (Lefroy).

Genus FORFICULA, Linn.

1. *planicollis* Kirb. Sandakphu, Darjeeling—Nepal border, 11,900 feet, October 1906, "amongst firewood," Nos. $\frac{634}{15}$ and $\frac{635}{15}$, ♂, ♀ (I. H. Burkill). Bhim Tal, Kumaon, 4,500 feet, 19th to 22nd September 1906, "feeding on flowers of stinging nettles," No. $\frac{620}{15}$, ♀ (N. Annandale).
2. *acer* Burr. Mussoorie, United Provinces, ♂ (Lefroy).
3. *beelzebub* Burr. var. Katmandu, Nepal, Nos. $\frac{1238}{15}$ and $\frac{1239}{15}$, ♂ ♂ (R. Hodgart). Nepal; Chitlong, No. $\frac{753}{15}$, ♀ (R. Hodgart).

These specimens agree with the type in structure, except that they represent the cyclolabia form, and the colour is different; instead of being of a uniform dull black, the elytra are clear brick red, the head is claret-coloured, and the abdomen is deep reddish black; I cannot find a true specific distinction, and therefore, for the present at least, range them as a cyclolabious colour-variety of *F. beelzebub.*

4. sp. (?). Assam, Nos. $\frac{248}{15}$ and $\frac{249}{15}$, ♀ ♀.

These are a distinct species, but I refrain from describing and naming them until the male is forthcoming.[1]—*April 14th*, 1907.

---

[1] Since this paper was sent to the press Mr. Burr has published a revision of the Forficulidæ (*sensu stricto*) and the Chelisochidæ (*Trans Ent Soc.*, 1907 (1), p. 91). This revision may necessitate considerable alteration in the generic names of the species recorded above.—ED., 13-viii-07.

XVI.—NOTES ON ORIENTAL DIPTERA.

III.—REVIEW OF THE ORIENTAL SPECIES OF *SEPEDON* LATR., WITH DESCRIPTIONS OF TWO NEW SPECIES.

By E. BRUNETTI.

Seven species of this genus were included in Van der Wulp's Catalogue (1896) of the Diptera of South Asia. Of these I believe I can identify four with specimens either in the Indian Museum collection or my own, and add two new ones taken by myself last year in Java. They all appear to be valid species and of four of them, *plumbellus*, *aënescens*, *ferruginosus* and a new species *sanguinipes*, I have examined a series of about a score of each. Two species I know from single specimens only (*crishna* Wlk. and *fuscinervis* mihi) and the remaining three I have not seen; these being *javanensis* Rob. Des. (figured in Macquart's "Diptères Exotiques"), *costalis* (1) Wlk., and *costalis* (2) Wlk., which latter, the name being preoccupied by the author himself in the same genus, I have renamed *batjanensis*.

Table of Oriental species of Sepedon.

A Front coxæ grey or blackish, with or without silvery white shimmer; *never yellow*.

B Abdomen plumbeous. Long. 4½-6½ mm.

C Apical half (or third) of wing distinctly darker; antennæ nearly or quite black (except the reddish yellow 1st joint); posterior femora generally with the apical half reddish. Long. 5-6½ mm. *plumbellus* Wied.

CC Wings uniformly light greyish brown—rarely darkened towards tip (if so only very slightly); antennæ

	brown, (sometimes darker at tip); posterior femora always uniformly tawny Long. $4\frac{1}{2}$-6 mm.	*aënescens* Wied.
BB	Abdomen tawny or ferruginous Long. 6-10 mm.	
D	Cinereous species; abdomen tawny; thorax with four indistinct lines Long. 9 mm.	*costalis* Wlk.
DD	Ferruginous species; abdomen ferruginous; thorax with two indistinct lines Long. 10 mm.	*batjanensis*, nom. nov. for *costalis* Wlk. (2) preocc.
AA	Front coxæ (generally *all* the coxæ) bright yellow or tawny (with little or no shimmer).	
E	Thorax black or blackish.	
F	Wings uniformly brownish; four anterior tarsi in ♂ enlarged Long. 7 mm.	*javanensis* R. Des.
FF	Wings not uniformly coloured; either apical part distinctly darker, or a suffusion along the veins; only the fore tarsi enlarged.	
G	Apical part of wing distinctly darker Long. 7-8 mm.	*sanguinipes* Bru., sp. nov.
GG	Wing suffused along the veins Long. 6 mm.	*fuscinervis* Bru., sp. nov.
EE	Thorax ferruginous ..	
H	Abdomen ferruginous Long. 5-7 mm.	*ferruginosus* Wied.
HH	Abdomen plumbeous Long. 7 mm.	*crishna* Wlk.

S. *plumbellus* Wied., 1830.

Ausser. Zweifl., ii, 577.

This species is fairly common in grass and weeds near water in and around Calcutta, probably occurring throughout Bengal. From Calcutta the Indian Museum possesses it showing dates from the end of January up to July. Dr. Annandale' collector took one ♀ early in May this year at Dharampur (5,000 feet) in the Simla hills. It differs from its close ally *aënescens* Wied. in several minor but generally consistent characters. Firstly, the wing is nearly always *distinctly* darker towards the tip, the basal half often being quite clear, whereas in *aënescens* it is uniformly pale brown and *never* clear at the base. The second distinguishing character is the antennæ, which are (exclusive of the reddish 1st joint) always black, or very nearly so, in this species, but much lighter, and brown, in *aënescens*. In *plumbellus* the posterior femora are often reddish on the apical half (in which case the base is generally paler yellow than the other legs), whereas in *aënescens* they are *always uniformly brownish yellow*, and the tips never black, as is often the case in this species.

S. aënescens Wied., 1830.

Ausser. Zweifl., ii, 579.

Although the author says wing with a brownish tip, enclosing the cross vein, I feel sure that I have correctly identified this species, and think Wiedemann's specimen must have been an abnormal one. In one or two specimens out of the series of sixteen in the Indian Museum collection, there is a *slight* darkening towards the tip, which is absent in most specimens. His description of the shining lead front, and the femora being distinctly mentioned as *not* red, and the extreme tip of the posterior femora *not* being black, lead me to suppose the Museum specimens are this species. Wiedemann's line as to the posterior femora being more or less brown towards the tip, applies to an occasional specimen, but the specific character is uniformly brownish yellow femora, quite different from the distinct *reddish* tinge on the apical half of many specimens of *plumbellus*. The Indian Museum series is from Bangalore, but I have two examples taken by myself at Shanghai on April 16th and May 6th, 1906. Wiedemann originally described both *plumbellus* and *aënescens* from China; probably both species, with *ferruginosus* Wied. and my new species *sanguinipes* are all distributed throughout the East generally.

S. costalis Wlk., 1859.

Proc. Linn. Soc. Lond., iii, 110.

Walker has described two species separately under this name, but neither has been seen by me. The author described the present species (♂) from the Aru Islands. I have had to place it and the next species in my analytical table according to the somewhat short descriptions supplied. Thus I have assumed by "abdomen and legs tawny" that the coxæ are tawny also. That they are good species I have no doubt, from the four spots on the face and frons. Both species seem to possess this number, whereas in *ferruginosus* Wied. and *crishna* Wlk., the only others bearing spots on the face, there are only two, and in *crishna* the mark is a small streak, not a "dot" as Walker terms it. In size, too, both this and the following species exceed their allies by two to three millimetres.

S. batjanensis, nom. nov.

Nom. nov. for *S. costalis* Wlk. (1861) preoccupied

Proc. Linn. Soc. Lond., v, 291.

Walker's second species under the name of *costalis* was described from Batjan, and appears quite distinct. The author calls it "ferruginous" as differing from "cinereous" under which term he described his Aru Islands species. The type is a ♂. I fail to understand Walker's remark "allied to *S. duplicans*," not being able to trace any such species. Immediately following his description of *S. costalis* (1) is a new species of his, *Lauxania duplicans*, which he could hardly confuse, or compare with a *Sepedon*. I presume his "hind femora denticulated" (in his Aru Islands species) refers to the row of spines present in all the species.

S. javanensis R. Des., 1830.

Essai sur les Myodaires, 677.

Figured in Macquart's Dipt. Exot., ii, pt. 3, pl. xxiv, 2, 2*a*, 2*b*.

(Syn.) S. javana, Macq., *loc. cit.*, ii, pt. 3, 177.

This species must be allied to my *sanguinipes*. From Macquart's plate, the wings appear to be uniformly coloured, whereas in my new species *sanguinipes*, they are quite distinctly darker towards the tip, and yellowish towards the costa.

Moreover Macquart mentions that the *four* anterior tarsi are enlarged in the ♂, whereas in all the examples of *sanguinipes* that I have examined, this enlargement is confined to the fore pair only. The longish hair below the four anterior tarsi, which Macquart mentions and figures as an additional or overlooked character of the species, is replaced in *sanguinipes* by the ordinary short pubescence common to all the species. As regards the dilatation of the fore tarsi, I find this is also the case in *ferruginosus* Wied. ♂; in both sexes in *sanguinipes*; and likewise in the single example of *crishna* Wlk. that I have seen, which is a ♀; so that the character appears to be common to several species in the genus, and not confined to the ♂ sex. In fact Macquart in his supp. iii, pt. 3, p. 219, to his previously mentioned work mentions a ♀ *javanensis* R. Des. with enlarged anterior tarsi. Again, Macquart's figure shows the posterior femora of uniform colour, whereas in my species the contrast is strikingly distinct between the bright yellow and brilliant red, with the extreme tip distinctly black; none of which characters appear in Macquart's figure. Moreover mine is a larger species, and lastly, Macquart shows the thorax rather lighter than the abdomen, with two very distinct black stripes, whereas in *sanguinipes*, the thorax is unicolorous blackish with the abdomen, and (when present) the two dorsal darker stripes are very indistinct.

S. sanguinipes mihi, sp. nov.

♂ ♀, Sœrabaya, Java, long. 7-8 mm.

Frons depressed, yellow, becoming brownish above, and nearly black on vertex, with a silvery leaden reflection seen from behind. Face below antennæ bright yellow, unmarked, cheeks a little darker; antennæ, 1st joint reddish yellow, bare; 2nd joint black, with short stiff hairs; 3rd black, slightly pale at base on upper side, with dorsal white arista. Proboscis yellowish brown with a few hairs. Thorax dull black, dorsum smooth and bare; lower part of sides with silvery leaden reflections seen from behind. Abdomen blackish leaden, sometimes with brownish reflections; bare, a few short hairs at tip. Legs, fore coxæ yellow, four posterior coxæ yellowish brown, all the coxæ in certain lights showing silvery white reflections: fore femora red, with black tips; middle femora generally all reddish, but sometimes yellowish for a greater or less part from the base, tips black; posterior femora, basal two-fifths bright yellow, the rest brilliant red, tip black; fore tibiæ dark brown or black; four posterior tibiæ variable, brown, reddish brown or blackish; tarsi dark brown or black; the fore pair distinctly wider than the middle and posterior pairs in both sexes. Wings grey, blackish towards tip, and slightly yellowish on anterior margin; halteres yellowish white. Described from about 30 specimens in the Indian Museum collection (where the type ♂ and ♀ are deposited) and my own.

With the exception of one ♀ taken near Calcutta, May 27th, 1907, in the Indian Museum, all the examples referred to were collected by me in the East and they record the following data: Sœrabaya, Java, 16th to 25th July, 1906 (in woods); Rangoon (about) February 9th, 1906; Hong-Kong, 5th March, 1906; and Calcutta, 22nd January, 1907 (in grass near ponds).

S. fuscinervis mihi, sp. nov.

♀, Sœrabaya, Java, long. 6 mm. The single example of this species was taken by me in company with the preceding, July 25th, 1906.

It varies by the wings being pale grey; without any yellowish colour on the anterior part; with the three longitudinal veins widely suffused from the discal vein to the wing border. Although I have only seen this one specimen, the wing suffusions appear to make it quite a distinct species. In all other respects it agrees with *sanguinipes*. In my collection.

S. ferruginosus Wied., 1830.

Ausser. Zweifl., ii, 577.

A common species in Calcutta and Rangoon, probably extending over a considerable area in this region. Its uniformly light ferruginous colour will distinguish it from all other species except *crishna* Wlk., which latter is easily separated by its leaden black abdomen. The coloration of the posterior femora is variable, the difference between the pale yellow basal half and bright tawny red apical half being sometimes very striking, whilst in some specimens the colour is almost uniformly tawny. In its yellow face it is allied to Walker's first species named *costalis* (from the Aru Islands), but *costalis* has four black spots on its face and four black lines on its thorax, whereas *ferruginosus* has only two black spots (which are on the frons) and only two narrow black thoracic lines, close together, which sometimes form one broad band by the intervening space being darkened.

S. crishna Wlk., 1861.

Proc. Linn. Soc. Lond., v, 291.

The only specimen that I have seen (a ♀ in the Indian Museum collection), and that I can identify with this species was captured by Dr. Annandale's collector at Matiana (8,000 feet), Simla hills, on 28th to 30th April, 1907. It agrees in every particular with Walker's description, except that he says the dorsum of the thorax is *black*, whereas in the present specimen it is uniformly light ferruginous with the rest of the body. I think Walker's specimen may have been discoloured, and that my identification is correct.

* * * * * *

Two other species were described by Wiedemann, *senex* and *imbutus*; they are from unknown localities, and are in the Vienna Museum. I mention them because the author's other three species all occur in the East.

S. senex Wied. is grey haired, with blackish brown antennæ, the 3rd joint being whitish at the base; the face is yellow, frons reddish yellow with two brown streaks, thorax with two blackish lines on dorsum, and a white shimmer on the sides and front; abdomen brown, or in certain lights, blue; wings deep yellow with brown tips; legs reddish yellow, posterior pair rather reddish with pale base; the fore pair and the tibiæ black. ♂ long. 5½ mm.

The deep yellow coloured wings mentioned by the author readily distinguish this species. Locality ?

S. imbutus Wied. is dull leaden, differing from *senex* in the reddish yellow base of the 3rd antennal joint; frons and face pearl bluish; wings very lightly yellow, tips distinctly brownish, the darker colour extending to and enclosing the middle cross vein. Minor differences as regards the colour of the legs are mentioned. ♂ long. 5 mm. Locality ?

Either of these species may be found in the Oriental Region.

XVII.—DESCRIPTION OF A NEW SNAKE FROM NEPAL.

By G. A. BOULENGER, *F.R.S.*

Oligodon erythrogaster, sp. nov.

Nasal undivided; portion of rostral seen from above nearly as long as its distance from the frontal; suture between the internasals shorter than that between the præfrontals; frontal much longer than its distance from the end of the snout, a little shorter than the parietals; no loreal, præfrontal in contact with the second upper labial; one præ- and two postoculars; temporals 2 + 2; six upper labials, third and fourth entering the eye; four lower labials in contact with the anterior chin shields; posterior chin shields two-thirds the length of the anterior. Scales in 17 rows. Ventrals 186; anal divided; subcaudals 45 (end of tail injured). Back pale brown, sides grey; two dark brown streaks, enclosing a yellowish vertebral streak, meeting on the tail, the prolongation extending to between the eyes; a dark streak and three narrow black lines on each side; a ∧-shaped dark brown band across the snout, passing through the eye; a broad dark brown oblique band on each side of the head, from the supraocular to the throat; belly vermilion red in the middle, white on the sides, with two regular series of semicircular black spots, confluent into two stripes posteriorly.

A single specimen from Nagarkote, Nepal, altitude 6,000 feet, presented to the Indian Museum by Major J. Manners Smith, V.C., C.I.E., No. 15850, Reptiles, Indian Museum Register.

A very distinct species, allied to *O. venustus*, Jerd., but well distinguished by its undivided nasal, its longer tail, and [illegible] remarkable coloration.

XVIII.—NOTES ON A COLLECTION OF MARKETABLE FISH FROM AKYAB, WITH A DESCRIPTION OF A NEW SPECIES OF *LACTARIUS*.

By R. E. Lloyd, *M.B., B.Sc., Captain, I.M.S., Surgeon Naturalist, Marine Survey of India.*

In February this year Mr. I. H. Burkill, Reporter on Economic Products to the Government of India, sent an agent to Akyab, on the Arakan Coast of Burma, to make a collection of the fish exposed for sale in the market. This collection, which includes no less than 69 different species, was handed over to the Indian Museum for investigation. Dr. Annandale, who looked through the specimens and identified some of the species, has invited me to complete the identifications and to publish the results.

The collection includes fish from both fresh and salt water, but even taking this fact into consideration, it is surprising to find so many different species of edible fish on sale in the market at one season. Their variety illustrates the great wealth of fish life in Indian waters.

Most of the species have been identified from Francis Day's admirable monograph on the fishes of India, and also by reference to his original collection, which is available for comparison in the Indian Museum. Several of the species show slight variations from Day's descriptions, and in one case it has been found necessary to describe a new species (*Lactarius burmanicus*).

The agent who collected the fish also gathered together information of various kinds about them, such as their Arakanese names, the season of the year at which they are common, the character of the water in which they are found, and their market value. Some of his statements are at variance with those of Day; but it must be remembered how difficult it is to obtain accurate information on such subjects. In the following list the statements in inverted commas are extracts from the notes of Babu Rajoni Kanta Das, who made the collection. All undefined references are to Day's *Fishes of India*. The classification adopted is that of Boulenger. The term "river fish" may here be taken to include all fish from water on the landward side of Akyab bar.

ELASMOBRANCHIA (SELACHII).

CARCHARIIDÆ.

1. *Carcharias gangeticus.*
2. ,, *laticaudatus.*

" Name *Nga man*; common; the fins are purchased by Chinamen for export; white fins fetch as much as one rupee per ℔."

ELASMOBRANCHIA (BATOIDEA).

PRISTIDÆ.

3. *Pristis cuspidatus.*

" Name *Nga man sway they.* Common from September to March; fins exported."

TRYGONIDÆ.

4. *Trygon uarnak.*

" Name *Leik chout*; common in the sea."

5. *Trygon walga.*

" Name *Phat shay*; common in the sea; a favourite food fish."

6. *Pteroplatea micrura.*

" Name *Htamanee*; common in the sea from October to March; highly esteemed as a food fish by the Arakanese."

MYLIOBATIDÆ.

7. *Aëtobatis narinari.*

" Name *Swan shay*; common in the sea from October to February; esteemed as food by the Arakanese."

It is interesting to notice that three of these rays are said to be common only during the winter months. It is well known that many of the tropical sharks and rays are viviparous and are frequently caught pregnant during winter and spring (Alcock, *Journ. Asiat. Soc. Bengal* (2) 1890, and other papers). Their frequent appearance in the market at that season is most probably due to the fact that they then come close to shore to produce their young, winter being the season of calms in the Bay of Bengal. This view accords with the well-established facts that the young of most shore fishes are to be found close to the shore, and that they migrate out to deeper waters as they grow larger (McIntosh, " Scientific Work on Sea Fisheries," Lecture 1, *The Zoologist*, 1907).

TELEOSTII (MALACOPTERYGII).

Clupeidæ.

8. *Clupea variegata.*

There are 14 ventral spines in front of the pelvic fins and 12 behind. *C. variegata* is defined as having 10 in front and 10 behind, while *C. chapta*, a closely allied form, has 19 before and 9 behind.

"Name *Taymi*, or *Nga tha tout too*; common during winter months in the river."

9. *Clupea ilisha.*

("Hilsa.")

"Name *Nga thalout*; common in the river from January to March, rare in other months; much esteemed as food; salted for export."

10. *Clupea lile.*

"Name *Sha shari wat toung*; common in the river during the rains."

11. *Engraulis taty.*

"Name *Nga pasha*; common throughout the year both in river and sea."

12. *Engraulis breviceps.*

This specimen closely resembles *E. taty*, but the proportion of the head to the body is as 1 : 7, and the anal fin arises in advance of the dorsal. The Arakanese seem to recognize the difference.

"Name *Nga ba*; generally taken from the sea; grows to 14 inches."

13. *Engraulis* sp.

A small damaged specimen resembling *E. indicus* in many ways; but the eye is much too large.

14. *Pellona indica.*

"Name *Myat san gyai*; common throughout the year in sea and river; its flesh is reputed a cure for fever, among the Arakanese."

15. *Coilia ramcarati.*

Typical except that the anal fin is somewhat short, containing only about 85 rays.

"Name *Nga lawa*; common throughout the year in both river and sea."

16. *Megalops cyprinoides.*

"Name *Cha bouk han*; only occurs in tanks."

Day also states that this fish, which is a true herring, occurs commonly in tanks, rarely in rivers.

CHIROCENTRIDÆ.

17. *Chirocentrus dorab.*

This is an interesting specimen as it differs from the description somewhat in its proportions: head to body, 1 : 6; height to length, 1 : 6. Day gives these proportions as: head to body, 1 : $6\frac{1}{2}$—$7\frac{1}{4}$; height to length, 1 : $6\frac{1}{2}$—9. Bleeker divides the species into two, *C. dorab* and *C. hypselosoma.* The present specimen agrees with his *C. hypselosoma.*

"Name *Nga darhay*; common in the sea throughout the year."

NOTOPTERIDÆ.

18. *Notopterus kapirat.*

This specimen resembles the type in having large scales on the cheeks, in having 105 rays in its anal fin, and in its proportions generally. It differs from the type in that the angle of the mouth is behind the centre of the eye, the dorsal profile is more convex than the ventral, and there is a slight concavity in the profile of the head. In these three points it approaches the type of *N. chitala.* It also has a wide scaleless flap of skin attached to the margin of the opercle. Such a flap is not mentioned by Day in the description of either species; but it is figured in the case of *N. chitala* alone.

"Name *Nga phay*; common in rivers from February to March."

OSTERIOPHYSI.

SILURIDÆ.

19. *Saccobranchus fossilis.*

"Name *Nga cray*; common in rivers and tanks."

20. *Plotosus canius.*

Both dorsal and pectoral spines are quite smooth on the exposed edge though serrated on the other; otherwise the specimen is typical.

"Name *Pin lay nga khoo*; common in the sea, sometimes enters the river."

21. *Pangasius buchanani.*

"Name *Nga tan*; common in the river during the rains; grows two feet in length."

22. *Clarias magur.*

"Name *Nga khoo*; a common tank fish."

23. *Arius cœlatus.*

Typical, except that the ventral fins are somewhat large, reaching nearly to the anal.

"Name *Nga soo*; common in the river and sea during the winter months."

24. *Arius gagora.*

I have included two specimens in this species, one of them being referred to in the Babu's notes as *Nga moot*, the other as *Nga sook*. They do not entirely resemble one another in their proportions, nor is either quite typical of *A. gagora* They both have a patch of globular palatine teeth on either side, so far back that they lie under the eye. The "*Nga sook*" is 10 inches long, the length of its eye is contained 7 times in the length of the head, 2½ times in the snout, and 3½ times in the interocular distance.

The "*Nga moot*" is 18 inches long, the eye diameter is contained 8 times in the head, 3 times in the snout, 4 times in the interocular distance. The head is somewhat flatter than that of the other specimen.

In both specimens the maxillary barbel is a little shorter than the head. They are both reported to be common in river and sea.

APODES.

Anguillidæ.

25. *Murænesox talabonoides.*

"Name *Thin bawhto*; found only in the river, not common; attains four feet in length."

26. *Ophicthys boro.*

"Name *Nga hout pru*; common in the river during the rains."

Murænidæ.

27. *Muræna macrura.*

"Name *Nga shing gra*; river and sea, not common."

HAPLOMI.

Scopelidæ.

28. *Harpodon nehereus.*

("Bombay Duck.")

"Name *Baraiga*; common, taken from the river chiefly."

PERSOCES.

SCOMBRESOCIDÆ.

29. *Belone cancila.*

"Name *Nga toung nhin*; plentiful during the rains, in the river"

POLYNEMIDÆ.

30. *Polynemus tetradactylus.*

"Name *Nga taya*; uncommon, taken usually from the sea; attains 3 feet in length."

31. *Polynemus indicus.*

("Topsee Fish.")

"Name *Luckwa*; common in the sea during the winter months; attains 40 inches."

32. *Polynemus paradiseus.*

"Name *Musi rhay*; common, usually taken at sea."

MUGILIDÆ.

33. *Mugil* sp.

34. ,, sp.

These two species of mullet closely resemble one another, but I have not been able to identify either of them with any of Day's species of the genus, most of which are separated by small distinctions. The two specimens resemble one another in the following features :—

The greatest depth of the body is more than the length of the head, which is $\frac{1}{5}$ of the total length; the dorsal fin commences half way between the end of the snout and the base of the caudal; the snout is equal to the diameter of the eye, which is half the interocular distance; the mandibles meet at an obtuse angle; both anterior and posterior eyelids are present.

They differ from one another in the following points :—

One specimen, which is called "*Nga man*," is 8 inches long and is said not to exceed this length and to be common in river and sea. Its anal fin commences well in front of the second dorsal; the pectoral is as long as the head; the head is convex from side to side, and the specimen has a yellowish tint in spirit.

The other species, which is called "*Nga cangying*," is said to be uncommon and never to be found in the sea; it is also said to attain a length of 14 inches. The second dorsal and the anal commence at the same level; the pectoral is not so long as the head, which is nearly flat.

These two forms seem to be different species. The smaller one is very like *M. dussumieri*, while the "*Nga cangying*" comes nearest to *M. planiceps*; but neither is quite typical of either species.

SPHYRÆNIDÆ.

35. *Sphyræna jello.*

"Name *Nga kyauk tying*; common in winter months in sea and river."

STROMATEIDÆ

36. *Stromateus sinensis.*

("Pomfret.")

"Name *Ruza na panat*; common in the sea; much esteemed."

37. *Stromateus cinereus.*

"Name *Ruzana*; common in the sea during the winter months; much esteemed as food; dried and exported."

OPHIOCEPHALIDÆ.

38. *Ophiocephalus striatus.*

"Name *Nga rin*; a common river fish."

ACANTHOPTERYGII.

SERRANIDÆ.

39. *Lates calcarifer.*

("Bekti.")

"Name *Nga tha dil*; common throughout the year in river and sea; attaining 3 feet in length; a favourite food fish."

40. *Serranus* sp.

An immature fish 4 inches long. Owing to the absence of colour in spirit certain identification is impossible.

"Name *Nga tout too*; sea and river; not common; grows to over 4 feet in length. The Chinese export the skin of this fish."

It is well known that the species of *Serranus* attain a very large size, and it is interesting to see that our Indian informant knows that this small fish grows to over 4 feet in length. It speaks well for his knowledge of fish. Apart from the mere difference in size, there is a considerable difference in general appearance between the young fish 4 inches long and a giant sea perch over 4 feet in length, for a *Serranus* of this size becomes very bulky and attains a great weight. There is a specimen of this genus in the Indian Museum that was over 7 feet in length and weighed 460 ℔.

41. *Lutianus johnii.*

"Name *Nga wat pani*; found in the sea only, not common."

42. *Therapon jarbua.*

"Name *Sa ba sa*; river fish, common during the rains."

43. *Ambassis urotænia.*

"Name *Nga san zat*; river fish, common in the rains."

SCIÆNIDÆ.

44. *Sciæna bleekeri.*

"Name *Nga pa thon*; sea and river fish, common in the winter months."

45. *Sciæna aneus.*

"Name *Ba sha*; common in river and sea throughout the year."

46. *Sciæna miles.*

"Name *Nga baragar*; common in the sea throughout the year."

47. *Otolithus maculatus.*

"Name *Taw ba la*; sea fish, not common; reaches 2 feet in length."

48. *Sciænoides pama.*

"Name *Wa marhi*; sea fish, common; said to attain a length of 12 inches only."

49. *Sciænoides microdon.*

"Name *Ro rhi*; common in the river; attains 4 feet in length."

These two forms, *Wa marhi* and *Ro rhi*, each represented by a single specimen, resemble one another very closely, but differ in the following points:—

The "*Wa marhi*" has ten spines in the first dorsal fin, and eight pyloric cæca; its præopercular edge has blunt, obscure crenulations, and the posterior angle of the maxilla falls behind the eye. This form agrees very closely with *S. pama.*

The "*Ro rhi*," on the other hand, has eight spines, four pyloric cæca, a finely serrated præopercular edge, and the posterior angle of the maxilla falling below the centre of the eye. This form agrees fairly well with *S. microdon*, which is defined, however, as having six pyloric cæca.

Our Indian informant says that the "*Wa marhi*" (*S. pama*) does not grow longer than 12 inches, while the "*Ro rhi*" attains a length of 4 feet. *S. pama*, however, according to Day, grows at least 5 feet long, while *S. microdon* is a small species. There is evidently a mistake somewhere, but it is noteworthy that local observation has established the fact that one species outgrows the other, especially as it requires careful examination, aided by dissection, to distinguish between the two, at any rate when they are presented in the form of museum specimens.

Both specimens show the lateral line continued along the middle of the tail to its very tip. This feature, which is very conspicuous, is neither remarked in the text nor illustrated in the figures of Day's monograph, in which (pl. xlv, fig. 2) the lateral line is clearly shown as ending before reaching the tail in the case of *S. microdon.*

CHÆTODONTIDÆ.

50. *Scatophagus argus.*

" Name *Bishat tara* ; common in the river and sea throughout the year ; esteemed as food " (in spite of its reputed habits).

DREPANIDÆ.

51. *Drepane punctata.*

" Name *Swin ma rwat* ; common in the sea during winter."

SCORPIDIDÆ.

52. *Psettus argenteus.*

" Name *Nga than zay* ; common in the sea in the winter months."

LOBOTIDÆ.

53. *Datnioides polota.*

" Name *Nga pan lun gaing* ; taken usually from the river throughout the year, but not common."

54. *Lobotes surinamensis.*

" Name *Kyauk nag pree* ; river fish, very uncommon."

LACTARIIDÆ.

55. *Lactarius burmanicus*, sp. nov.

The single specimen differs so widely from *L. delicatulus*, the only other known species of the genus, that it has been necessary to describe it as a new species. The diagnosis is printed at the end of this paper.

" Name *Ah phying zar* ; common throughout the year in river and sea."

SILAGINIDÆ.

56. *Sillago domina.*

"Name *Nga rwan nat*; not common, taken occasionally in the river in the winter months."

PRISTOPOMATIDÆ.

57. *Diagramma crassispinum.*

"Name *Kyauk nga wat*; taken occasionally in the river during the winter months."

SPARIDÆ.

58. *Chrysophrys datnia.*

"Name *Nga wat*; common in the river during the winter."

GERRIDÆ.

59. *Equula edentula.*

"Name *Nga wagy*; common in river in winter months."

ACANTHOPTERYGII (SCOMBRIFORMES).

CARANGIDÆ.

60. *Caranx gallus.*

"Name *Nga bya byay*; common in the river in the winter."

61. *Caranx sansun.*

"Name *Nga ohn*; common in the sea in the winter months."

62. *Chorinemus lysan.*

"Name *Nga khin ba*; common in the sea throughout the year."

TRICHIURIDÆ.

63. *Trichiurus haumela.*

"Name *Nga tha rway mingya*; common in the winter months in the sea; its flesh is a reputed cure for fever; attains 3 feet in length."

64. *Trichiurus muticus.*

"Name *Nga tharway*; common throughout the year in river and sea; a reputed fever cure."

ZEORHOMBI.

PLEURONECTIDÆ.

65. *Cynoglossus lingua.*

"Name *Khwa sha*; common throughout the year in river and sea; esteemed by Europeans."

GOBIIFORMES.

GOBIIDÆ.

66. *Gobius viridipunctatus.*

"Name *Un doat ma tha*; river fish, common in the rains."

67. *Gobioides rubicundus.*

"Name *Nga yit ni*; common river fish."

68. *Boleophthalmus dentatus.*

"Name *Doung brout*; common river fish."

SCLEROPAREI.

PLATYCEPHALIDÆ.

69. *Platycephalus insidiator.*

"Name *Nga prunkhat*; river fish, not common."

DESCRIPTION OF A NEW SPECIES OF THE GENUS LACTARIUS.

Lactarius burmanicus, sp. nov.

B 7—D 7 1-22—P 16—A 3.28.

Ll. 85. Trv. $\frac{\frac{11}{1}}{20}$ at widest point. P.C. 6.

The description has been drawn up after comparing the specimen with four examples of *L. delicatulus* (the only other known species of the genus) from Malabar. These examples agree with Day's figure and description of the species and with the earlier description of Cuvier and Vallance.

The new species differs from *L. delicatulus* in the following points :—

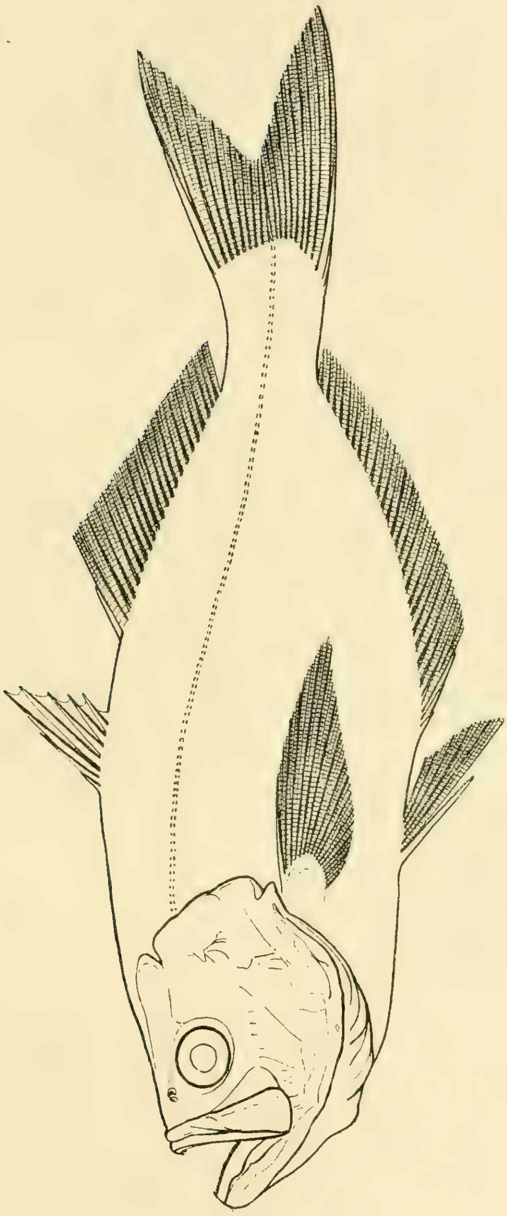
1. The diameter of the eye is $\frac{1}{4}$ of the total head length ($\frac{1}{3}$ in *L. delicatulus*), and the snout is longer than the eye.
2. The first dorsal fin is separated from the second by an interval at least as wide as the base of the first dorsal

measured between the first and last spines (in *L. delicatulus* it is considerably less).

3. The ends of the ventral fin just touch the first anal spine.
4. The pectoral fin is as long as the head.
5. Perhaps the most marked difference is in the teeth of the upper jaw. In examples of *L. delicatulus* I find that in addition to two well-marked canines, the upper jaw has a single series of small pointed teeth on the biting edge of the premaxilla in its front half. Posteriorly these pass into a wide band of minute viliform teeth, at least ten deep transversely, situated on the inner side of the premaxilla in its posterior half. Day only mentions the front or single series. In *L. burmanicus*, except for well-marked canines, the anterior half of the premaxilla is toothless, but on the inner side of this bone in its posterior half there is a wide band of very minute teeth. There are one or two minute teeth on the vomer, and a small band of teeth on either palatine. In the lower jaw there are 30 small teeth on either side and 3 canines close to the symphysis.

In all other points this species resembles *L. delicatulus*.

The type of *L. burmanicus* is 14 inches long, while Day says that *L. delicatulus* attains a length of 10 inches and Cuvier and Vallance one of 9 inches. The former species is said to be common in the river and sea at Akyab throughout the year, and to grow to 16 inches long.



Lactarius burmanicus, sp. nov., × $\frac{3}{5}$

XIX.—DESCRIPTIONS OF TWO FRESH-WATER OLIGOCHÆTE WORMS FROM THE PUNJAB.

By J. STEPHENSON, *Major, I.M.S., Professor of Biology, Government College, Lahore.*

(1) ÆOLOSOMA, sp.

The worm of which the following is a description is very common in and near Lahore; it inhabits standing water, and may often be found in large numbers in the foul-smelling sediment at the bottom, and also in and amongst algæ of various kinds. It lives well in small vessels in the laboratory; specimens were examined at various times during April 1907.

Examined with a lens when moving freely at the bottom of the vessel, they appear to glide smoothly forward in an extended condition, without the numerous twists, expansions, and contractions of parts of the body that are seen in the case of other small Oligochæta. On a slide and under a cover-glass they are seen to be extremely contractile, rapidly altering their shape, now short and contracted, now long and extended. They remind the observer somewhat of small Turbellarians.

The individuals vary very greatly in length, according to the degree of extension of the body, and also according to the particular phase of asexual reproduction in which they happen to be. A single individual showing no sign of approaching division may measure about 3 mm.; usually, however, specimens are longer, show one, two or more constrictions, and may reach 8 mm. There is a well-marked prostomium, followed by a narrower pharyngeal and œsophageal region; the region of the stomach is thicker again, and behind this the body is uniformly cylindrical to the posterior end. The whole body shows a large number of spherical, ovoid, or irregularly shaped green bodies scattered in the surface epithelium; their colour varies slightly; they may be a pure bright green, or green with a shade of brown, or a light yellowish-green; the latter shades were noticed more frequently, and the pure green less frequently, after the animals had lived for some time in the laboratory. I do not think that these bodies had themselves ever any tinge of blue; there appeared to be at times a bluish tinge in the other parts of the skin, due to smaller, less defined, somewhat refractile particles of a very faint blue colour, so faint as to be almost colourless.

Segmentation.—The prostomium is large, broad and somewhat shield-shaped (*v.* pl. viii, fig. 1). It is broader than the following segments, and is ciliated at its rim and on its ventral surface. No ciliated pits were seen, but ciliary action appeared sometimes to be especially well marked in two grooves leading to the angles of the mouth; possibly the grooves were not permanent. The smallest number of serial setal bundles met with in a complete animal was ten; and animals showing a larger number than this showed also, both by the arrangement of the bundles and by commencing constrictions, that they were preparing to divide (*v.* diagrams in text-fig. 1). The normal number of segments for a single individual is thus probably about eleven.

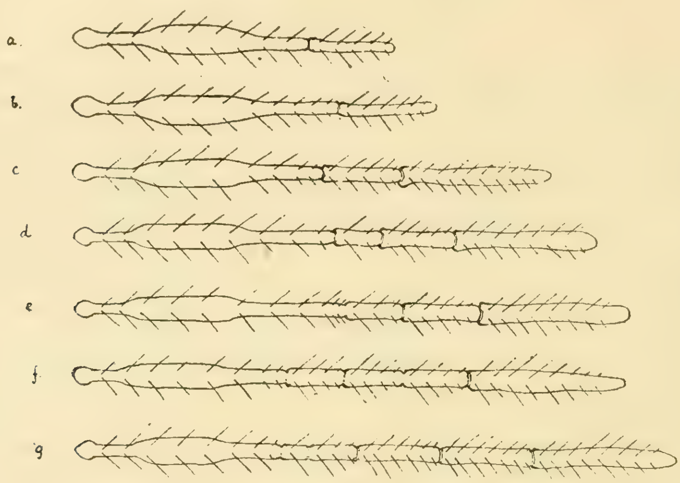


FIG. 1.—Diagrams illustrating various phases of asexual reproduction in *Æolosoma* sp.

Asexual multiplication.—Diagrams illustrating various phases are shown in text-fig. 1. It will be seen that the anterior, or original, animal of the chain bears eight, nine, ten or eleven serial setal bundles; but of these the last, or the last two or three, are evidently (as is indicated in the diagrams) of new formation. The zone of budding, therefore, seems to arise after the seventh or perhaps sometimes the eighth setal bundle, *i.e.*, after the eighth or ninth segment; and the intercalation of two or of three segments in this place and subsequent fission would give us the "normal" individual of eleven segments referred to above. In the hinder part of the chain the division into individuals seems to be much more irregular; thus in text-fig. 1 *f* we appear to have had the establishment of three zones of budding behind each of three originally successive segments.

Setæ.—Both dorsal and ventral setæ are of the same type,—long, smooth, straight, hair-like; in both dorsal and ventral bundles, however, shorter setæ may be present, sometimes alternating with the longer ones in their position in the bundle; but though varying in length all are of the same type. The *ventral* bundles contain usually from four to six setæ; the *dorsal* bundles contain from two to six and are, on the average, somewhat longer than the ventral. The general length of the setæ may be said to be about equal to the diameter of the animal. Both groups of setæ begin in the second segment.

Body-cavity.—There are no lymph-corpuscles in the body-cavity. There is one very definite septum, at the sides of the pharynx, representing the division between first and second segments. Besides this there are a large number of connecting strands between the alimentary tract and the body-wall: they are fine and thin in the region of the pharynx, thicker posteriorly between the intestine and body-wall, where they have a granular protoplasmic appearance. At the site of a future division they are thicker and more numerous, the condition almost amounting to a fusion between intestine and body-wall. Numerous strands are inserted into the dorsal blood-vessel.

Alimentary tract.—The mouth is bordered ventrally by a prominent lip, mobile and ciliated. There is no buccal cavity separate from the pharynx; the œsophagus occupies the second and third segments and is of approximately uniform diameter throughout; bunches of oval or spherical granular cells may be seen attached to it in a grape-like fashion, especially posteriorly (*v.* pl. viii, fig. 3). The stomach occupies segments 4-7; it is not very sharply delimited from the intestine; it may contain in its wall a number of spherical colourless globules, or perhaps vacuoles, about the same size as the green bodies in the skin. The intestine, which follows, may also contain a number of particles in its walls; but these are more refractile, less regular in shape, somewhat smaller, of a faint bluish tinge, and are apparently of the same nature as the similar bodies described in the skin; they also occur in the wall of the dorsal blood-vessel. Antiperistalsis is frequently observed throughout the length of the alimentary canal as far forwards as, and sometimes including, the stomach; and a reversed ciliary action (postero-anterior) is constantly going on in the intestine. Diatoms and mineral particles are found in the stomach and intestine.

Vascular system.—The blood is colourless and contains no corpuscles. The dorsal vessel is contractile; it bifurcates in the prostomium in front of the mouth, and the branches unite to form the ventral vessel beneath the pharynx. There are no transverse commissures.

Nephridia.—The nephridia are coiled tubes, with small ciliated funnels lying unattached in the body-cavity. The first occurs behind the first setal bundle; seven may sometimes be distinctly counted, while at other times there are apparently only six. None appeared to be modified in any way.

Nervous system.—The cerebral ganglion appears under two shapes; sometimes as a simple, transversely placed oval mass, sometimes having in addition two lateral, posteriorly directed, rounded cornua. It is much easier to see in some cases than in others, but is never very prominent. While the two forms shown in fig. 4 may certainly both be recognised in different animals, the difference may possibly be explicable, partly at any rate, by a difference in the degree of protrusion or retraction of the prostomium; the effect of protrusion might be to double back the ends of a normally oval-shaped, transversely-placed ganglion. I have, however, no observations to show whether this is so, as it is impossible to follow the shape of the ganglion during any movement of the animal. There are no pharyngeal commissures and no ventral cord. Fine hairs, perhaps sensory, are distributed over the whole body. On the under surface of the prostomium are certain cells which stain a deep blue on the addition of a little methylene blue to the water in which the animal is being examined; these may perhaps be special sense-cells.

No *genital organs* or clitellum were seen.

The above described species of Æolosoma appears to have most affinity with *Æ. headleyi*, Beddard, of which I transcribe the specific characters as given in Michaelsen's *Oligochæta.* "*Kopflappen breiter als die folgenden Segm. Oeldrüsen leuchtend grün, manchmal ins Bläuliche spielend. Borsten sämtlich lang, haarförmig, S-förmig geschweift. Gehirn hinten grade abgestutzt* (?). 8-9 *Nephridien-paare, erstes hinter dem* 1 *Borstenbündelpaar. Mässig gross* (*L. ca.* 2·5 *mm.* ?)."

The question of colour and of the site of the element of blue in the species here described has been entered into above, and also the question of the shape of the cerebral ganglion, about which in *Æ. headleyi* there would appear, from Michaelsen's note of interrogation, to be some doubt; I do not, however, think that in any case its shape could, in the species now described, be said to be "cut off straight behind." A greater number of nephridia is given for *Æ. headleyi* than those I have been able to count. The length is perhaps not a very important point.

There remains only the question of the setæ. I cannot find that in this species there is any S-shaped curve; they may, of course, be temporarily curved through the resistance of the water or pressure of the cover-glass; but examined at rest, without a cover-slip, such a curve, if present at all, is of the very slightest, and is not S-shaped.

The general resemblance, however, of this form to *Æ. headleyi* would appear to be considerable, and it may be possible to unite the two under that name.

The above species will doubtless receive formal description and a specific name from Dr. Michaelsen in his Monograph on the Indian Oligochæta, soon to appear; as, however, it is difficult to be certain of details of internal anatomy in preserved specimens, it seemed worth while to give a description based on examination of the living animal; so that, although appearing before Dr. Michaelsen's work, the above notes are really supplementary and logically posterior to it.

(2) CHÆTOGASTER PELLUCIDUS, n. sp.

The following interesting form was obtained in the tank in the pleasure-gardens at Shalimar, and was also found in fair numbers in the duck-pond in the Lahore Zoological Gardens. Specimens were under observation in the laboratory at various times during April 1907.

External characters.—The worm is much larger and thicker than *C. punjabensis*, recently described from Shalimar. The ordinary length is about 5 mm., but some of the longer chains, especially when extended, may reach 10 mm. Its general shape will be immediately understood by a reference to the figures in plates ix and x; fig. 1, however, was drawn from a somewhat contracted specimen, and the usual shape is more accurately expressed by some of the other drawings. The animal is very transparent.

It seems unnecessary to describe a prostomium, the mouth being large, obliquely placed ventro-anteriorly, and reaching to the anterior extremity of the animal. The pharyngeal region is beset externally with a large number of minute irregularities, probably small chitinoid, or at least cuticular, elevations (*v.* fig. 1), mostly elongated in an antero-posterior direction; their shape and disposition are represented in text-fig. 2. The anus is terminal. The animal is very contractile, and may, in this condition, appear to be little more than half its normal length, and double its normal thickness. It moves largely by means of these contractions and extensions of the body assisted by its setæ; in backward progression the hinder end of the body may be first over-extended, then sharply flexed; the setæ, with their points directed forwards, are thus brought to impinge forcibly on any subjacent object, which serves as a point of resistance as the animal thus jerks itself backwards. In anterior progression the points of the setæ are directed backwards.

Segmentation.—The rudimentary nature of the prostomium has been mentioned; neither it nor any of the succeeding segments are marked off by any external annulation, and other means of delimiting the segments also fail us in the anterior part of the body. As elsewhere, the first group of setæ may be supposed to mark the second segment; but posterior to this there is a region of the body which is entirely achætous, which possesses no nephridia, where the ventral nerve cord is not marked by distinct ganglia, and where the septa also are irregular or wanting. There can, however, be little doubt that the second group of setæ belongs to the sixth segment, since this is the rule in the genus *Chætogaster*, to which in other respects the present form shows a close correspondence. In *C. punjabensis*, for example, the segments can be counted by means of the septa; and there can be no doubt of the close relation between that species and the present form. The body is continued posteriorly to a variable length, the segments being marked throughout this extent by definite septa, by the setal bundles and by nerve ganglia. The shortest animal I have met with (text-fig. 2) showed in all eleven segments, and this may be taken as the normal length of a single individual.

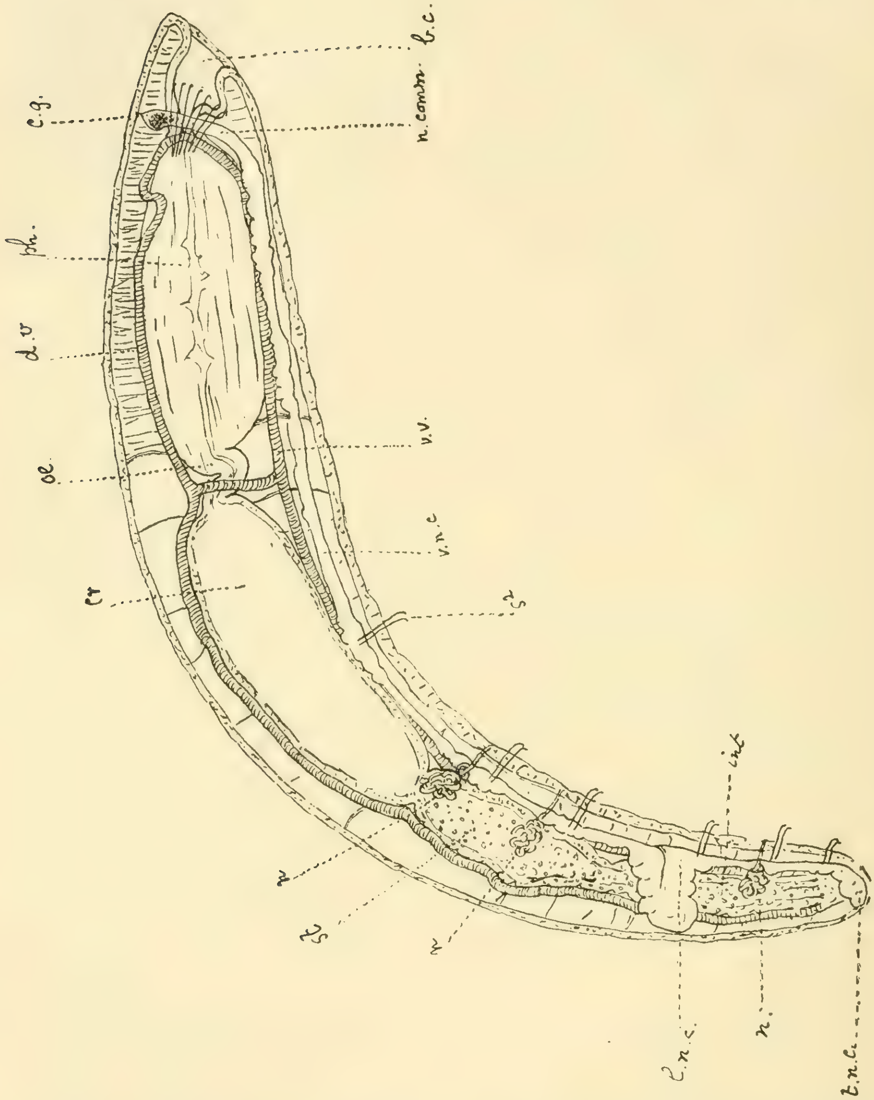


FIG. 2.—An animal of eleven segments; the lateral expansions of the nerve-cord are well seen. The blood-vessels are indicated by cross-shading. The nephridia here and in subsequent figures are diagrammatic.

Asexual reproduction.—The "normal single individual" is, however, very rarely met with; since in the large majority of cases indications of approaching fission are evident. Indeed, speaking strictly, I believe that such indications are always to be met with, and that even in the specimen represented in text-fig. 2, the arrangement of the nephridia and the lateral extension of the nerve-cord (here unusually evident) indicate preparations for renewed division.

Figure 3 shows a specimen which is slightly longer than the above, has an additional nephridium, and is producing new segments posteriorly, as indicated by the terminal minute new setæ. This—and the same applies to several of the figures referred to in the following few paragraphs—was drawn originally to illustrate other points; the nerve-cord is here not represented, but an irregularity of the septa about the ninth and tenth segments probably indicates the production of new segments at this place.

Figure 4 represents a considerably longer animal. A definite constriction divides it into two halves, of which the anterior is in exactly the condition of text-fig. 2; the posterior contains also three nephridia, with an interval between the second and third, where a lateral extension of the nerve-cord is beginning to grow dorsalwards. This posterior portion evidently only requires the elongation of its fore-part and the addition of the first setal bundles to bring it also into the stage of the animal represented in text-fig. 2.

Figure 5 shows this elongation and addition of the first setal bundles (directed from the first forwards, not perpendicularly outwards) as having taken place. But in this and the subsequent examples the two chief components of the compound animal have, before separation, developed further than the already separated individual of text-fig. 2, which seems to have become free at an unusually early stage. There seems here to be a slight irregularity in the development of the nephridia.

Figure 6 shows, as measured by the number of segments and the development of the nephridia, a more advanced stage than the last, though the actual division into two is apparently more remote. It shows a typical distribution of the nephridia; and a number of extremely minute, newly developing setal bundles, distinguishable only with the high power, afford a good demonstration of the various positions where new segments are being intercalated.

Figure 7 illustrates again the slight irregularities which may occur in the time of appearance of the nephridia. This specimen contains one nephridium less than the last, though the most anterior setal bundle of the posterior component is better developed, and the minute setæ at the zones of budding are—or were in the original specimen—rather more in evidence. In this, as well as figs. 5 and 6, it will be seen that attention has been paid to the irregularities of the skin surface at the sites of future division. Figure 1 shows a very similar stage.

The longest animal of which I have any note, was also the only one in which reproductive organs were seen. Sexual and asexual modes of reproduction do not, therefore, exclude each other, Here the two chief components each consisted of three portions.

so that the whole chain was composed of six individuals or their rudiments. As regards the posterior of the two chief components, its anterior section was sufficiently distinct, while a further subdivision in front of the sixth setal group, reckoned from behind, was evidenced by the constriction and absence of nephridia at this part. The corresponding subdivision in the anterior animal was less evident owing to the non-development, up to that time, of nephridia behind the level of the slight constriction.

We can now, I think, summarize the history of asexual reproduction in this species as follows: The normal single individual consists of about eleven segments, but, in the spring of the year at any rate, it is seldom found, and does not usually separate till it has attained a greater length than this. It contains, typically, two nephridia in the seventh and eighth segments; it also shows already a zone of budding behind the eighth segment; a nephridium, if present in the tenth segment, will ultimately become the first of a posterior animal. About eight segments are intercalated at the zone of budding, the three anterior of which belong to the anterior half, and the five posterior become the anterior five segments of the second animal; the setæ of the ninth original segment become the second setal bundle, *i.e.*, the setæ of the sixth segment, of the second animal. The posterior end of the whole animal produces three new segments, whereby we now have twenty-two in all, eleven for each half. The animal, however, seldom divides at this stage, the components remaining attached until at least a part of the above cycle has been repeated in each of them.

Setæ.—There are no dorsal setæ. The ventral setæ are slender, somewhat small compared with the size of the animal, slightly curved in an $\int$ shape, with two unequal prongs and a small nodulus (*v.* text-fig. 3 A). Those of the second segment are directed

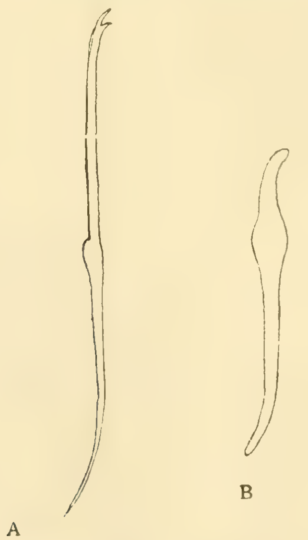


FIG. 3.—A, ventral seta of *C. pellucidus*; B, genital seta.

anteriorly, and when brought into use are spread out in a fan-shaped manner; they do not, at rest, reach the mouth, and I have not seen them used for prehension of food. The next bundle of setæ belongs (*v.* ant.) to the sixth segment, and is situated about the junction of the middle and posterior thirds of the crop. The two following bundles are placed in the region of the stomach; other bundles follow segmentally to the posterior end of the body.

The number of setæ in each bundle is very commonly five; or, in the second segment, six or seven; two, three and four are also met with.

In the only specimen met with which showed sexual organs, the setæ of the sixth segment were modified (*v.* text-fig. 3 B). They were shorter, stouter, with well-marked nodulus, not forked, and did not project. In another specimen which, however, had no sexual organs, these setæ were shorter than those of the next segment, and did not project as much; they had the usual two prongs.

The setal sacs are not conspicuous, the internal ends of the setæ appearing to be merely connected with a number of fine radiating contractile strands. The setæ may be rotated; the hooked free end pointing sometimes forwards and sometimes backwards, according to the direction of progression, except probably in the case of the first setal bundle.

Body-cavity.—The body-cavity is traversed by septa, of which the first is well-marked, thick and situated behind the pharynx; the second is thinner and is placed at the beginning of the crop; these two may be taken as delimiting the second and third segments posteriorly. The next definite septum is near the posterior end of the crop, and there is also a septum at the middle of the stomach; these show the extent posteriorly of the sixth and seventh segments: septa occur intersegmentally in the posterior part of the animal.

Besides the septa, there are a number of irregularly placed fine strands passing between alimentary canal and body-wall, especially numerous and perhaps contractile in the region of the pharynx.

On one occasion a number of corpuscles were observed in the body-cavity; these contained a number of colourless, refractile, oil-like globules, of different sizes, in their substance. Usually, however, the body-cavity is free from corpuscles.

Alimentary canal.—The mouth is large, circular, placed ventro-anteriorly, and reaching as far as the anterior tip of the animal. The buccal cavity (*v.* text-fig. 4 C) succeeds, with the nerve commissure round its sides; the pharynx is conspicuous, occupying the second segment, attached by strands to the body-wall, and having normally only a narrow lumen. The œsophagus (text-fig. 2, and pl. ix, fig. 1) is a narrow tube leading to the crop; it occupies almost the whole of the third segment. The crop is the dilated portion of the canal in the fourth, fifth, sixth and part of the seventh segments; it is usually empty, and its walls are clearer than is the case in the stomach and intestine. A constriction in the seventh segment separates the crop from the stomach, the latter being also distinguished from the crop by the number of yellowish, refractile, oil-like globules in its wall: it frequently has a somewhat rhomboidal shape, owing to its being pulled out laterally by the attachment of the septum. The intestine follows, also dilated at the insertions of the septa; its walls are of the same character as those of the stomach. Ciliary motion may sometimes be detected in the intestine, but it is not of a conspicuous character, nor definitely in a postero-anterior direction, as is commonly the case in small aquatic Oligochæta.

These animals are carnivorous; on two occasions I found two specimens on a dead fly in the water; the stomach and intestine of others showed Paramœcia and other Ciliata, small Crustacea, Rotifers and Anguillulæ in their interior.

Circulatory system.—The dorsal vessel is contractile, the contractions progressing from behind forwards; it is attached to the dorsal wall of the intestine, stomach, crop and œsophagus, except at the angle between œsophagus and pharynx; it is again attached to the wall of the pharynx in its posterior part, and becomes free anteriorly before it divides. It is continued as two lateral vessels at the sides of the buccal cavity, immediately posterior to the nerve-commissures (*v.* text-fig. 4 C), which unite

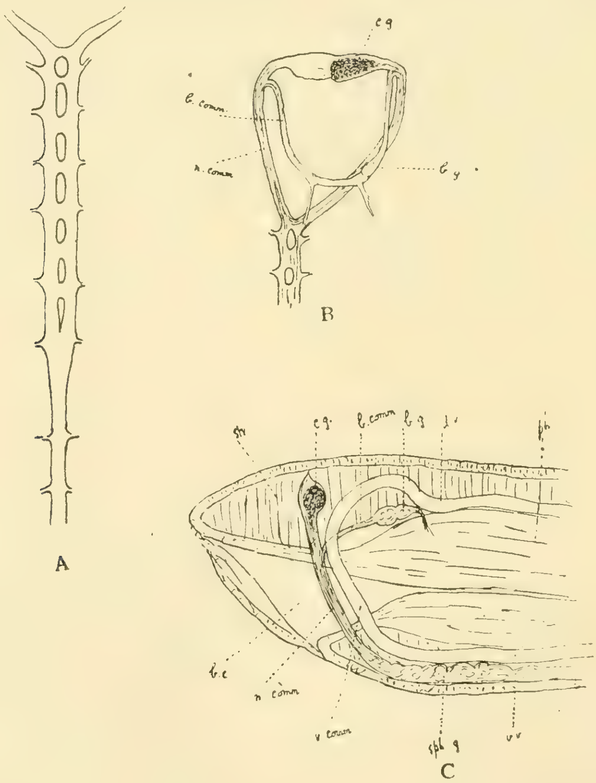


FIG. 4.—A, anterior part of ventral nerve cord of *C. pellucidus*, in the extended condition; B, cerebral and buccal ganglia and their commissures; C, anterior end of animal, from the side. (Reference letters as in Plates ix and x.)

ventrally in the ventral vessel. This is not contractile and is not attached to the wall of the alimentary canal. A pair of transverse connecting vessels (*v.* text-fig. 2) which are contractile are situated in the œsophageal segment in front of septum $\frac{3}{4}$. There is a capillary plexus in the wall of the crop similar to that described in *C. punjabensis* (*v.* pl. ix, fig. 10). The blood is colourless and contains no corpuscles.

Nephridia.—The nephridia are long, finely coiled tubes, not attached to the septa, and without funnels; no ciliary motion is visible within them. Their position has been described above, and may be seen in the various figures.

Nervous system.—The cerebral ganglion is situated dorsal to the buccal cavity; it is indistinctly bilobed, elongated transversely, and may appear somewhat nodular in outline. The commissures are continued from its antero-lateral angles. The ganglion frequently contains a quantity of granular opaque matter; this may be aggregated into an ovoid mass (text-fig. 5 A) in the

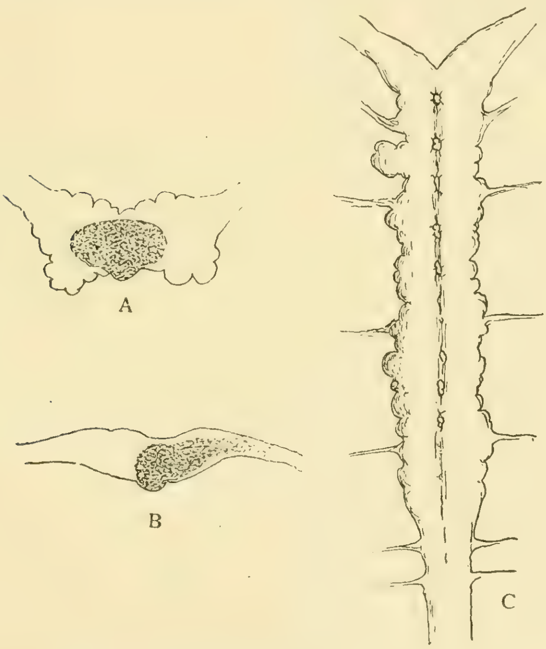


FIG 5.—A, cerebral ganglion of *C. pellucidus*, with symmetrical ovoid granular mass; B, the same, granular matter mainly unilateral; C, anterior part of ventral nerve-cord, in the usual somewhat contracted condition of the animal.

deeper and more posterior part of the ganglion; or it may extend as scattered granules some distance along the commissures; or it may be confined to the right (text-fig. 5 B) or left half of the ganglion; or it may be absent altogether. But even when most closely aggregated, the mass never has the bright shining appearance of the refractile particle in the cerebral ganglion of *C. punjabensis*, but is always dark and opaque.

The commissures lie at the sides of the buccal cavity and unite below; about one-third of their length from the cerebral ganglion they each give off a branch which proceeds in a posterior and dorsal direction, and curving inwards unites with its fellow in a loop dorsal to the pharynx; this loop shows two ganglionic swellings, one on each side, which are very evident in text-fig. 6,

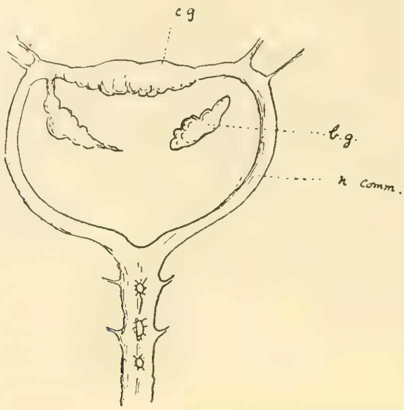


FIG. 6.—Anterior part of nervous system of *C. pellucidus*: buccal ganglia obvious, buccal commissures indistinct. (Reference letters as in Plates ix and x.)

though the connecting strands were here scarcely discernible. The fibres appear to enter the loop from the ventral portion of the buccal commissure, not from the direction of the cerebral ganglion (*v.* text-fig. 4 B and C).

The ventral nerve-cord shows the longitudinal division into two in its anterior portion, which is characteristic of the genus. This is best seen when the animal is well extended; the separation between the halves then takes the form of elongated oval spaces with bridges passing from side to side between them. In the much more usual (under examination) somewhat contracted condition, the longitudinal division of the cord is much less marked, and appears as a series of small circular buttonholes with puckered margins (*cf.* text-figs. 4 A and 5 C); in this condition the outline of the cord is irregularly nodulated. This longitudinal division extends almost as far as the posterior end of the pharynx.

The ganglia are placed in each segment after the fifth at the level of the setal bundles. In the anterior part of the body they are not clearly distinguishable, though on a lateral view a slight thickening of the cord appears to exist anteriorly where it is formed by the union of the commissures, and again just behind the posterior limit of the pharynx. The first ganglion, however, that is clearly recognisable is that of the sixth segment; all are seen better in a lateral view than in one from the ventral surface.

The lateral expansions of the nerve-cord at the site of a future division of the animal have been already referred to, and are illustrated in text-fig. 2; the terminal expansion in this particular case probably denotes that the animal has recently divided. The expansions are quite similar to those I have already described in *C. punjabensis*; they are more marked on the posterior side of the actual line of constriction, where they appear to develop into the nerve-commissures of the posterior animal (*cf.* some examples in figs. 5 and 6).

Sense organs.—A few fine hairs are seen at the anterior end of the body. The granular matter in the cerebral ganglion doubtless corresponds to the refractile particle in the same situation in *C. punjabensis.*

Reproductive organs.—I found these organs only in one specimen (which was also dividing asexually), although within a few days of this I looked through a fair number of examples with a view to discovering others.

The male organs (*cf.* fig. 9) are situated opposite the middle region of the crop; a small spherical mass, in which no structure could be discerned, and seen only on one side, perhaps represents the testis; to its outer side lies a tube, straight or doubly bent, ending internally in a dilated portion, and externally on the surface at the level of the setæ of the sixth segment. A swollen part of this tube near its external aperture is occupied by an ovoid somewhat granular mass, and the external aperture itself is funnel-shaped. I could not distinctly see an internal opening at the other end of the tube, nor was ciliary motion anywhere visible. The genital setæ have already been described; there is a development of hairs around the aperture; and the skin is thickened here, so that seen laterally (fig. 10) there is a slight protuberance.

Scattered throughout the body, in the posterior as well as in the anterior of the two as yet undivided animals, were numerous sperm-morulæ; various stages in the development of these are represented in fig. 8, beginning with a small globular hyaline mass, in which the individual cells are but faintly visible with the high power of the microscope, and ending with a wisp of enveloped spermatozoa. The male products would therefore seem to ripen while floating free in the body-cavity.

The ovaries, of which one is shown in fig. 9, develop on the anterior face of septum $\frac{6}{7}$; one ovum, in the figure referred to, is seen to be much larger than the rest; it had a clear refractile germinal vesicle which was enclosed by a zone of protoplasm somewhat clearer than that composing the mass of the egg. The receptacula seminis (as I take them to be) are two sacs, attached near their fundus to the septum at the anterior end of the crop (septum $\frac{3}{4}$), and opening exteriorly as shown in fig. 9: they were of a hyaline appearance, and no distinct structure could be observed. No oviducts were seen. No clitellum was distinguishable.

The specimen whose reproductive organs are here described was examined on April 24th; the water containing it had then been kept in a vessel in the laboratory for a few weeks.

GENERAL REMARKS.

The animal described above agrees in most points with the definition of the genus *Chætogaster* as given by Michaelsen. It differs, however, in not possessing a greatly elongated third segment, which is a characteristic of the genus as described by him; for though, as has been said, there is some difficulty in delimiting the anterior segments, still the third appears to be defined by septa on each side, and, as in *C. punjabensis*, to be practically commensurate with the œsophagus; and apart from this, whatever the exact limits of the first six segments may be, there is hardly room for any one of them to be "greatly elongated" without cramping some of the others almost out of existence. The receptacula seminis of this genus are also said to be in the fifth segment, while I have described them above as attached to the posterior face of septum $\frac{3}{4}$; I would not, however, lay too much stress on the condition of the single, apparently not fully developed, specimen, in which these organs were found.

On the other hand, the resemblances between this form and the various species of the genus *Chætogaster* are many and evident; such, especially, are the absence of the dorsal and the arrangement of the ventral setæ, the single pair of lateral transverse blood-vessels, and the separation longitudinally of the anterior part of the ventral nerve-cord into two. It will be better, therefore, for the present to place this form in the genus *Chætogaster*, as was done with *C. punjabensis*, and as Annandale has done with the allied species recently described by him; and I propose the specific name *pellucidus* for it.

Besides the presence of the cuticular prominences on the head, the distribution of the nephridia, the details of the asexual mode of reproduction, and the co-existence of asexual with sexual reproduction, a few further points of interest present themselves for remark.

With regard to the granular matter contained in the cerebral ganglion, it is interesting to recall the crescentic refractile particle in *C. punjabensis*, the sense-organ (? otocyst) in the cerebral ganglion of *C. bengalensis* (Annandale, *Journ. Asiat. Soc. Beng.*, New Ser., vol. i, No. 4, 1905, p. 117), and the definite otocyst (a relatively large, globular, transparent cyst) of *C. spongillæ* (*ib. id.*, vol. ii, No. 5, 1906, p. 188). With this may perhaps be brought into connection the condition in *C. diastrophus* (Gruith.), a European species, in the definition of which Michaelsen says, "gehirn mit medianer Chitin (?)-Platte am Hinterrande." It seems possible that we have here a series of degenerative changes, from the fully-developed organ of *C. spongillæ*, through the doubtful otocyst of *C. bengalensis*, to the apparently solid aggregate in the brain of *C. punjabensis* and the chitin-like plate at the posterior part of the brain of *C. diastrophus* (*cf.* the position in *C. punjabensis*); finally we have the dispersal in granular form of this solid matter, as in most specimens of *C. pellucidus*, or its entire absence, as in other specimens; the variability in amount and distribution of this granular matter being perhaps correlated with the fact of its being here a "rudimentary organ."

What may be called the "buccal nerve commissure" does not appear to have been described in other species of *Chætogaster*; but here again *C. diastrophus* shows a related condition, the œsophagus being surrounded at its middle by a ganglionic ring. In *C. crystallinus* (Vejd.) a similar ring surrounds the anterior end of the œsophagus; and the condition in *C. pellucidus* may be derived from this by supposing a still further forward shifting of this ring, which now takes origin from the commissures at the sides of the buccal cavity; as might be expected on the supposition of the homology of these structures, the fibres of the buccal commissure of *C. pellucidus* are derived from the ventral side, not from the cerebral ganglion.

The genital hairs and genital setæ seem worthy of note. The latter appear to be modified in a direction contrary to what is usual; they abort to some extent, and cease to project. Since in this form the normal setæ (and the same is the case in *C. punjabensis*) project ventrally in a vertical direction, with little or no lateral inclination, they could, if retained, only be a hindrance to copulation, and their abortion probably allows a closer apposition, necessary in the case of aquatic forms.

As to the segments in which the reproductive organs are contained, the ovary is evidently in the sixth segment; as, being at the level of the setæ of this segment, is also the opening of the vas deferens. The anterior portion of the vas deferens and the testis may, following the rule for the genus, be supposed to lie in the fifth segment, though there is here no means of fixing segmental limits. As previously said, the receptacula appear to be in the fourth segment; this is unusual in the Naididæ, and it may possibly be the case that the septa in front and behind the œsophagus are septum $\frac{3}{4}$ and $\frac{1}{5}$ respectively, not $\frac{2}{3}$ and $\frac{3}{4}$ as I have assumed; in this case the œsophagus would occupy the fourth, not the third segment, and the pharynx both second and third, there being then no septum between the second and third segments. My numbering of the anterior segments of *C. punjabensis* would also in this case require revision.

The absence of a clitellum, and the development of the spermatozoa while floating in the body-cavity are noteworthy.

On the Indian Species of the Genus Chætogaster.

Michaelsen (Oligochæta) in 1900 enumerates five species of Chætogaster, all from Europe. Annandale, in describing *C. bengalensis*, mentions that the genus has also been found in America, referring, perhaps, to *C. gulosus*, Leidy, 1852, which Michaelsen calls doubtful, and of which he gives no description. Within the last two years five species have been recorded from India, so that the extent of the genus has been doubled. The new species are *C. bengalensis* and *spongillæ* from Calcutta, described by Annandale (*loc. cit.*) ; another species not yet fully described and referred to by Annandale, its discoverer, in his second paper as *C. sp.* ; and *C. punjabensis* and *pellucidus* from Lahore by me.

The literature of the European (and American) species is not accessible to me ; but they appear to form a well-marked, homogeneous group, which, while agreeing with the Indian species in its broad outlines are separated from these latter by the elongation of the third segment and the absence of sense-organs or their rudiments. As to the first of these points, whatever be the exact delimitation of the segments in the anterior part of the bodies of the Indian specimens, it can be seen by referring to the published figures (as has been already mentioned for *C. pellucidus*) that, taking the first setal bundle to belong to the second segment, and the second setal bundle to the sixth, there really is no room in any of them for a greatly elongated third segment. As to the second point, the chitinous (?) plate in the brain of *C. diastrophus* may represent a link of connection between the two groups. Another connecting link between the groups may be seen in the buccal nerve-commissure of *C. pellucidus* which, as stated above, may be compared with the circum-œsophageal ganglionic ring of two of the European species.

But whatever may be the case regarding these two geographical groups and their relationship, the Indian species appear to me to be closely related and to form a well-defined assemblage. Besides the characters already mentioned, which differentiate them from the European species, the conformation of the alimentary canal and, as I hope to show, the normal number of segments of the animal and the mode of asexual reproduction, agree in the various members. The small cuticular projections on the head of *C. pellucidus* are also to be compared with the longitudinal rows of minute irregular tubercles on the head of *C. spongillæ* and the small projections of the epidermis on the ventral surface of the anterior sucker of *C. bengalensis* ; and the peculiar shape of the nodulus (the projection being one-sided and more abrupt distally) on the setæ of *C. bengalensis* and *pellucidus*—though it may be found not to be confined to these two species—seems worthy of note.

The mere reading of the descriptions of the alimentary tract would lead one to suppose that there was a marked difference between the Punjab and Bengal forms. For example, in *C. bengalensis* Annandale speaks of a narrow slightly coiled passage succeeding the pharynx, and leading into the œsophagus ; the œsophagus being a large sac (*v.* fig. in text) divided by a permanent constriction into two : to the œsophagus (which is thus the longest part of the alimentary tract) succeeds the intestine. The Punjab species, on the other hand, are described as having a small œsophagus, large dilated crop, stomach also considerably dilated, and lastly the intestine. It is, however, easy to see by referring to the figures that Annandale's "slightly coiled passage " is my œsophagus ; the first dilatation of the œsophagus corresponds to the crop, and the second to the stomach. I had not seen Dr. Annandale's paper when I wrote my description of *C. punjabensis*; and in the above account of *C. pellucidus* I have followed my former nomenclature, since it still seems to me more convenient to have separate names for permanent and separate structures; and so long as such names are not taken to imply homologies I think they are unobjectionable. Dr. Annandale, having access to the literature of the subject, may have used his names in accordance with the practice of European writers on the genus; though it appears that in those species the œsophagus is small, and never longer than the pharynx. In any case, if the terms "crop" and "stomach" are rejected, I would suggest that the division between "œsophagus" and "intestine" be taken at the line between my "crop" and "stomach," —not behind the "stomach"; the difference in character of the walls changes at this point, at least in the two species with which I am acquainted. Detailed descriptions of the alimentary tract of *C. spongillæ* and *C. sp.* are not given; but the same two dilatations, in the same relative positions, are seen in the figures of both; and in all five species the relation of the crop (or first dilatation of the œsophagus) to the setæ of the sixth segment (which occur about one-third the length of the crop from its posterior end), and of the stomach (or second dilatation of the œsophagus) to those of the seventh and eighth segments, is the same.

The above is merely a question of nomenclature; what follows has to do not merely with nomenclature, but also with a difference of interpretation, especially with regard to the appearances which Annandale describes in his three forms as the clitellum. It must always be dangerous to draw conclusions on *à priori* grounds by arguing from one form to another, however closely related; and I feel that my temerity is especially great when these conclusions conflict with the interpretations given by Dr. Annandale after his examination of the forms themselves. But I cannot help thinking that the appearances described and figured in his two papers as the clitellum of his three species are the same as those I have called the zones of budding; and that the clitellum is really the site of a future division of the animal, and is not concerned with sexual reproduction in any way.

Reference to Annandale's figures, and a comparison with those given in the present paper and those previously given in the account of *C. punjabensis*, will show that the clitellum corresponds in position to one of the sites of future division. Thus the clitellum is stated to occupy the tenth and eleventh segments in *C. bengalensis*; the figure of this species, which shows the clitellum as being behind the setæ of segment 10, may be compared with the anterior half of the as yet undivided animal shown in fig. 5 of the

---

[1] Not strictly in the case of *C. bengalensis*, in which the setæ of the ninth segment also come into relation with the stomach; unless indeed (which I think possible) a second, less permanent, constriction towards the posterior end of the stomach in this form represents the division between stomach and intestine in the others; the relations of the setal bundles to the divisions of the alimentary tract would then be identical throughout.

present paper; they differ only in the fact of an extra, newly-developed group of setæ in front of the constricted zone in the latter specimen; or, if the figure of *C. bengalensis* is compared with the posterior part of fig. 5, the correspondence is only incomplete as regards the number of segments at the posterior end of the animal. Similarly the figure of *C. bengalensis* resembles the anterior half of fig. 7 of the present paper, with this difference, that very minute new setæ are beginning to form in the region under discussion in the latter.

The figures of *C. spongillæ* and *C. sp.* in Annandale's second paper may be compared with the present fig. 4; the bud in fig. 4 shows a few more segments than the buds in Annandale's figures, the clitellum, however, corresponds to the lateral expansion of the nerve-cord behind the eighth segment in fig. 4; the length of the interval between this and the next and more prominent constriction appears to be two fully developed segments in *C. spongillæ*, three in fig. 4, four in *C. sp.*

The nature of the change at this region also appears to correspond; the clitellum is not a specially protuberant region, as in other Naididæ, but appears to be somewhat, if only slightly, constricted, and the figures appear to give evidence of a slight superficial transverse wrinkling of the skin. This is comparable with what occurs at this situation in *C. pellucidus*. In Annandale's figures, again, the alimentary tract is somewhat blurred and indefinite at this region; I have found this to be the case on account of the lateral upgrowths of nervous matter, and also because of a closer connection between the tract and the body-wall.

The statement that the clitellum exists even in young animals just separated (in *C. bengalensis*) may be compared with what was stated above, that even the youngest free animal (*cf.* text-fig. 2 and pl. x, fig. 3) shows the commencement of formation of a zone of budding behind the eighth segment. The fact that the clitellum is achætous may be explained by a reference to fig. 7; the extremely minute newly developing setæ of this specimen would have been absent had it been examined a little earlier, and would not have been detected as it was, had not a high magnification been employed.

I have not, even in the sexual animal, noted a clitellum; the zone of budding, the nature of which is evident, occurs however in the same place. But I wish to guard against saying that a clitellum does not occur; it probably develops later; in *Nais* and *Pristina*, according to my observations, it is not present until the genital products are far more conspicuous than they are in the sexual *Chætogaster* above described. And I would mention, in conclusion, that the Limicolæ have (so far as known) the clitellum on the genital segments themselves; a clitellum in *Chætogaster* on the tenth and eleventh segments would be much posterior to the genital segments.

The above comparisons seem to me to show that the structures described by Dr. Annandale and myself in different ways are really the same thing; and if I am justified in interpreting his figures in the above manner we have, probably, throughout the Indian species, the development of a zone of budding behind the eighth segment, and consequently a normal length for the animal somewhat greater than this, though separation may be delayed and the typical single individual may possibly in some species never, or hardly ever, be met with in practice.

The chief differences exhibited by the Indian forms appear to be the following: The suckers of some forms are instances of adaptation; anterior and posterior are described in *C. bengalensis*, anterior only in *C. spongillæ*. The number of setæ in a bundle is greater in *C. bengalensis* than in the other forms. The first pair of nephridia are larger than the others in *C. bengalensis* and *C. sp.*; the first nephridium appears to be in the sixth segment in *C. bengalensis*, in the seventh in the others (not mentioned in the account of *C. spongillæ*). The nerve ganglia of *C. bengalensis* and *C. spongillæ* are described as being of a discrete nature, not corresponding in arrangement with the segmentation of the body; while in the Punjab species the ganglia and segments correspond posteriorly at least; if in *C. pellucidus* the lateral branches of the anterior portion of the cord be taken to represent the number of fused ganglia, then here also we have a larger number of nervous segments than of body-segments.

EXPLANATION OF PLATE VIII.

ÆOLOSOMA, sp.

FIG. 1.—General view of the animal seen by transparency from the ventral surface. The blood-vessels are shown in their anterior portions only, and nephridia only on one side.

FIG. 2.—Side view of the posterior portion of a chain.

FIG. 3.—Head and œsophageal region, more highly magnified, seen by transparency from the ventral surface.

FIG. 4 *a* and *b*.—Two forms of the cerebral ganglion.

An., Anus; *c.*, cells round œsophagus; *con.*, constriction between successive members of a chain; *d.v.*, dorsal vessel, seen through the superficial structures; *i.*, intestine; *l.*, lip; *m.*, mouth; n^1, n^2, n^7., first, second and seventh nephridia; *n.g.*, nerve ganglion; *o.*, oil-cell; *œ.*, œsophagus; *ph.*, pharynx; *pr.*, prostomium; *s.*, setæ; *s.h.*, sensory hairs; *sp.*, septum; *s.s.*, setal sac; *st.*, stomach; *str.*, strands uniting intestine and body-wall; *v.v.*, ventral vessel, dividing to encircle pharynx.

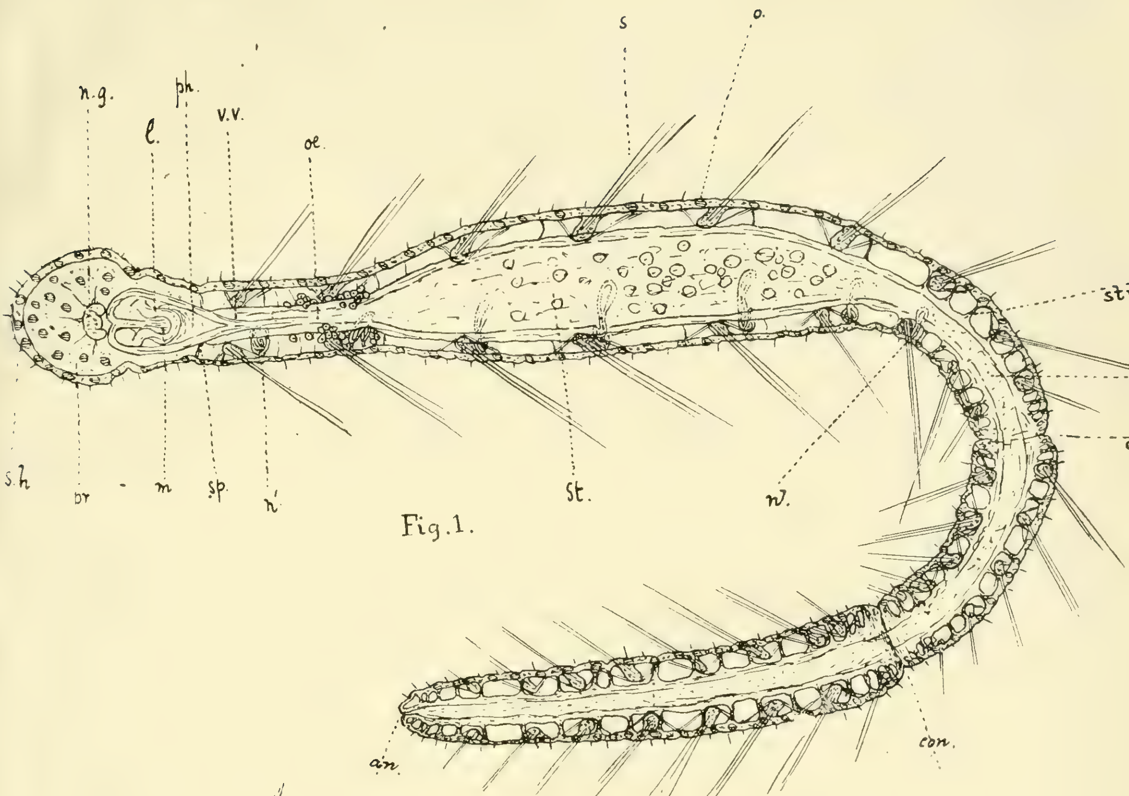
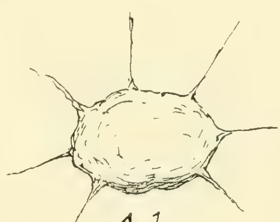


Fig.1.

4. a.



4 b.

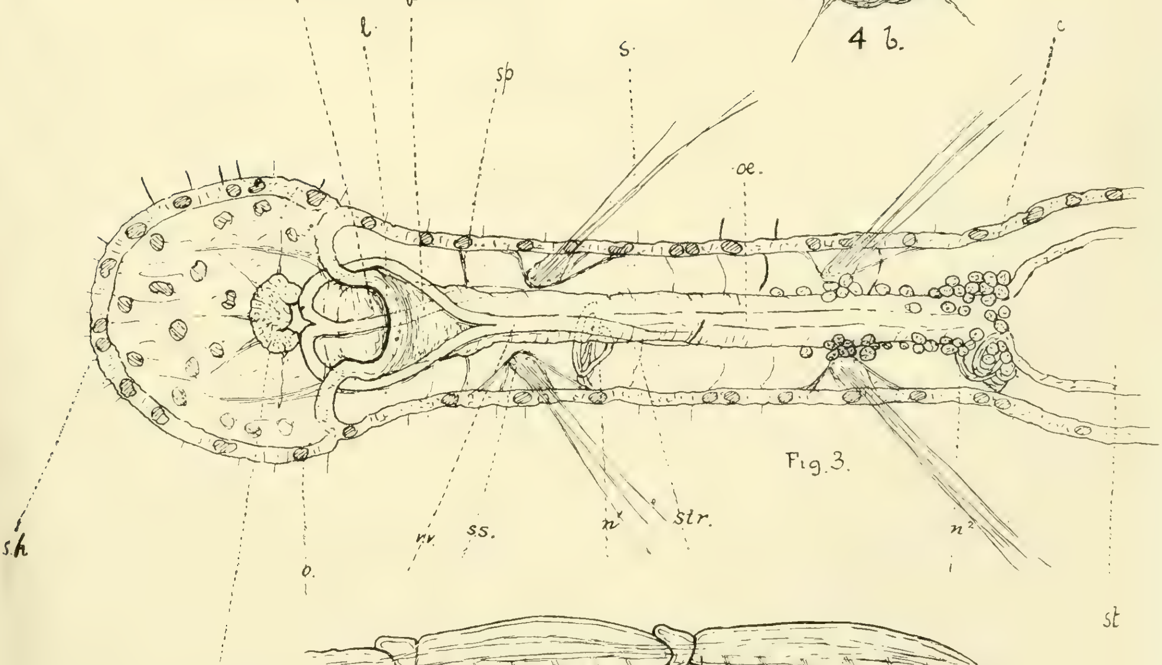


Fig.3.

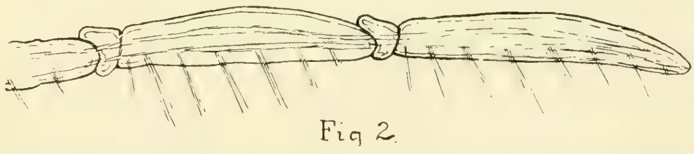


Fig 2.

EXPLANATION OF PLATES IX AND X.

CHÆTOGASTER PELLUCIDUS, n. sp.

FIG. 1.—General view, seen (as are the others) by transparency.

FIG. 2.—(See text-fig. 2, p. 238.)

FIGS. 3, 4, 5, 6, 7.—Semi-diagrammatic representations of successive stages in the growth of the animal. The Roman numerals at the sides of the figures represent the numbering of the segments: it should be noted that the first bundle of setæ behind any constriction becomes the bundle of the sixth segment of the posterior animal. Hence in these figures vi is placed opposite such setæ, although the anterior five segments of the animal may not have yet grown so as to be recognisable.

FIG. 8 *a*, *b*, *c*, *d*, *e*, *f*.—Successive stages of development of the sperm-morulæ.

FIG. 9.—Region of crop, showing genital organs: ventral view.

FIG. 10.—The region of the male aperture: lateral view.

An., anus; *b.c.*, buccal cavity; *b. comm.*, buccal nerve commissure; *b.g.*, buccal ganglion; *c.g.*, cerebral ganglion; *con.*, constriction, which will ultimately divide the animal; *cr.*, crop; *cr* ., crop of second animal; *d.v.*, dorsal blood-vessel; *g.s.*, genital setæ; *h.*, genital hairs; *int.*, intestine; *int* ., intestine of second animal; *l.n.c.*, lateral expansion of nerve-cord at sites of future division; *m.*, mouth; *n.*, nephridium; *n. comm.*, the nerve commissures; *œ.*, œsophagus; *œ* ., œsophagus of second animal; *ov.*, ovary; *r.s.*, receptaculum seminis; *ph.*, pharynx; *ph* ., pharynx of second animal; *s* ., first bundle of setæ (of second segment); *s* ., second bundle of setæ (of sixth segment); *s.m.*, sperm morulæ; *sp.*, septum; sp^1., the first septum, *i.e.*, septum $\frac{2}{3}$; sp^2., the second septum, *i.e.*, septum $\frac{3}{4}$; *sph. g.*, subpharyngeal ganglion; *st.*, stomach; *st* ., stomach of second animal; *str.*, strands of tissue between alimentary tract and body-wall; *s.s.*, small setæ, visible only with the high power at zones of budding; *t.*, testis; *t.n.c.*, terminal expansion of nerve-cord; *v. comm.*, vascular commissure in head; *v.d.*, vas deferens; *v.n.c.*, ventral nerve-cord; *v.v.*, ventral vessel; ♂, male aperture with genital setæ.

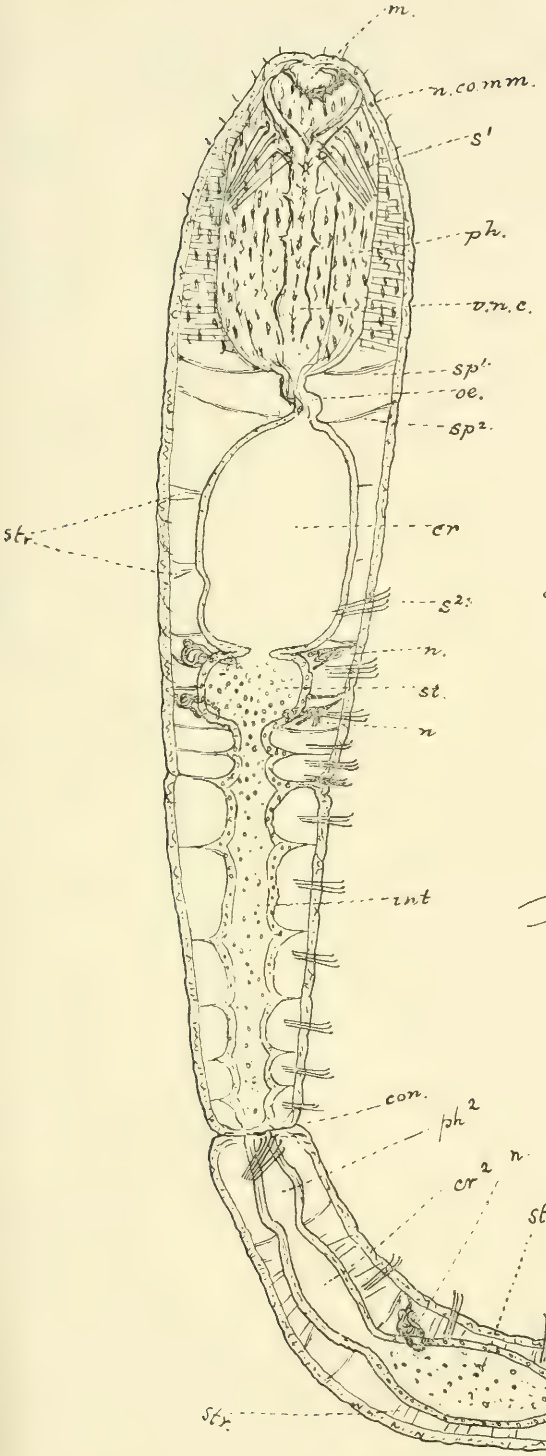


Fig. 1.

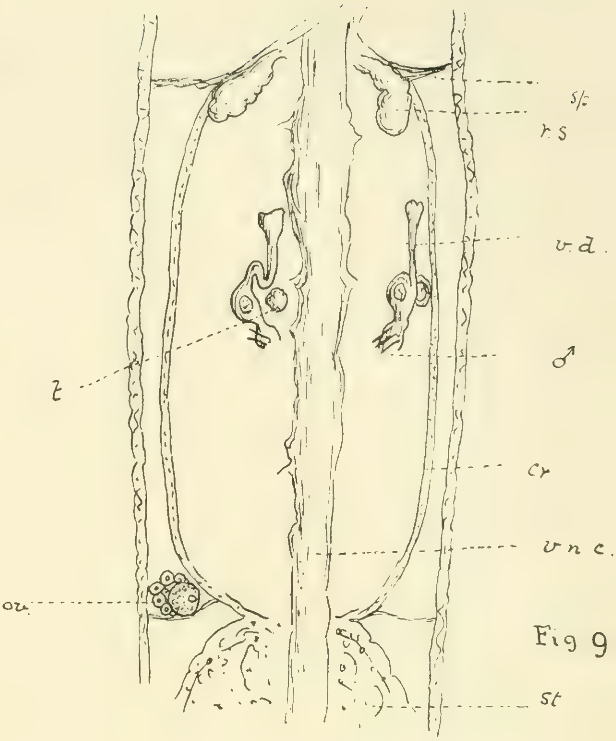


Fig 9.

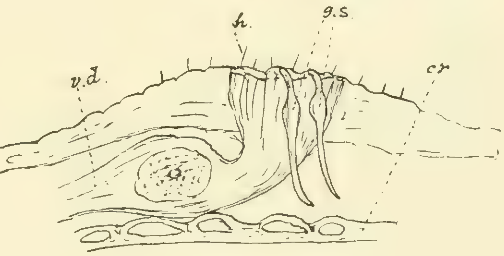


Fig. 10.

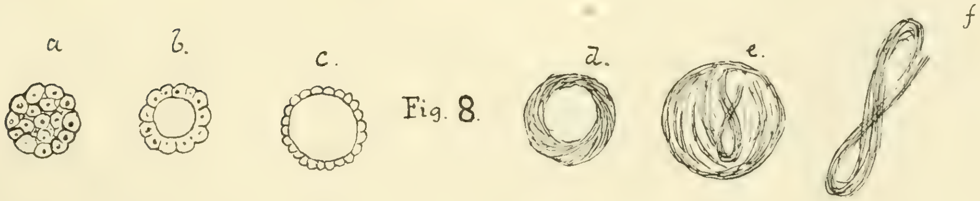


Fig. 8.

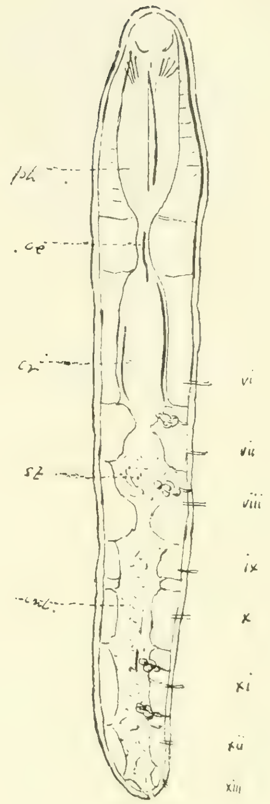


Fig. 3.

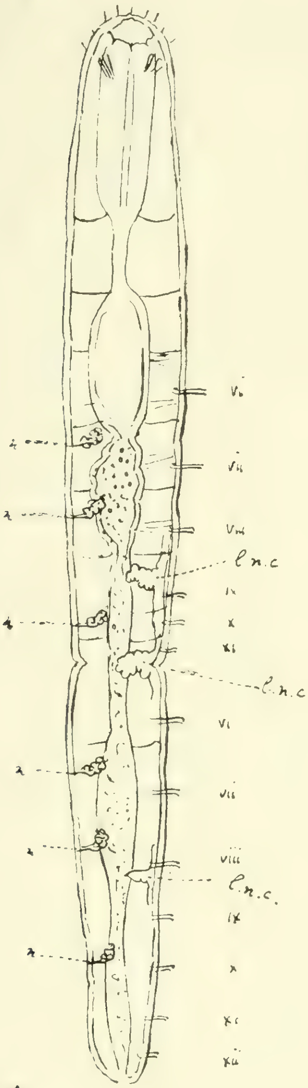


Fig. 4.

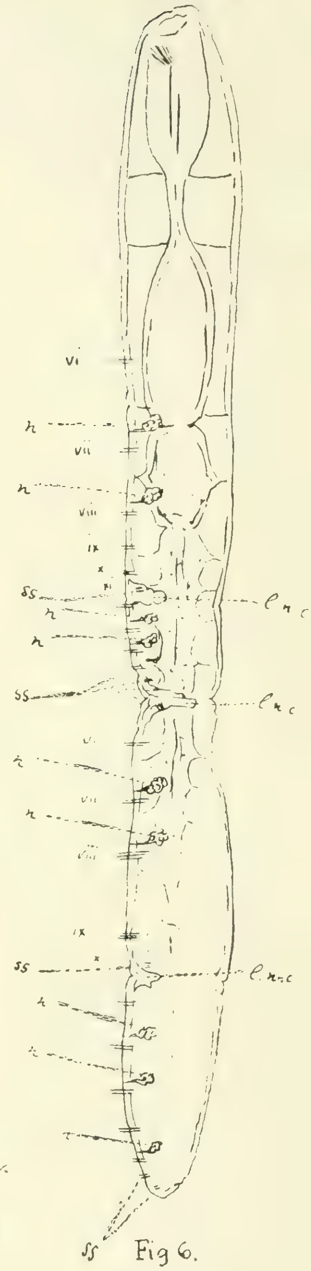


Fig. 6.

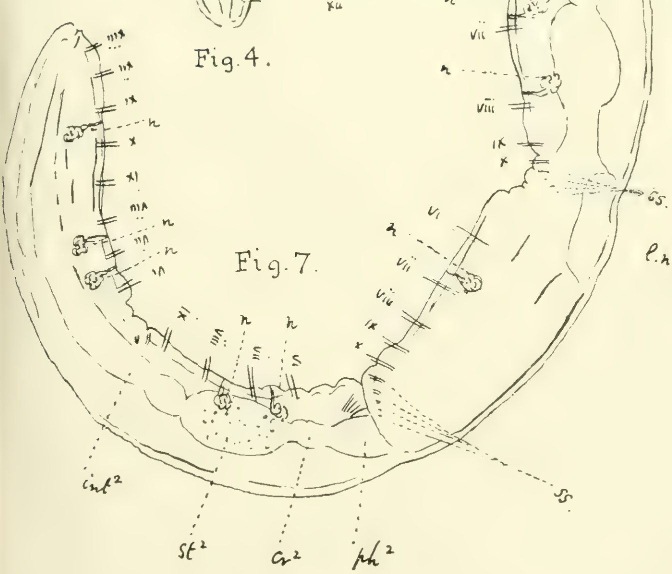


Fig. 7.

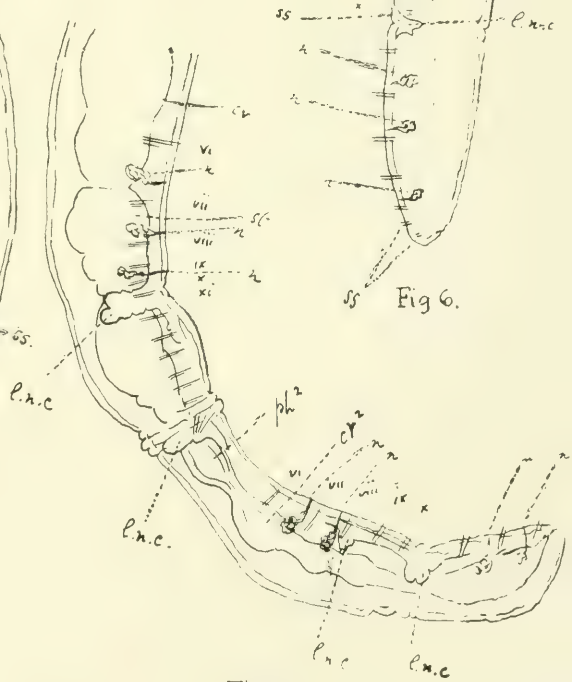


Fig. 5.

XX.—NOTES ON PHOSPHORESCENCE IN MARINE ANIMALS.

By R. E. LLOYD, *M.B., B.Sc., Captain, I.M.S., Surgeon Naturalist, Marine Survey of India,*

WITH

A DESCRIPTION OF A NEW POLYCHÆTE WORM.

By A. WILLEY, *D.Sc., F.R.S., Director, Colombo Museum.*

Towards the end of 1905, the R.I.M. Survey Ship "Investigator" trawled five times in the shallow waters of the northern part of the Persian Gulf. On one of these occasions the trawl was lowered late in the afternoon, so that the process of preserving the specimens had to be carried out in the dusk of the evening. While depositing some of them in formalin, my attention was arrested by a fine display of illumination by one of them,—a certain active Polychæte.

Before dropping this worm into the solution, no phosphorescence was noticed, but under the stimulus of the irritant, two rows of brilliant points of light, one on either side of the animal's back, became visible, and remained so for several seconds before gradually fading away.

These points of light were circular in outline, and about the size of a small pin's head. It was noticed that they were separated by equal intervals, that they appeared less in number than the segments, that they were situated about the bases of the parapodia, and that they were very prominent.

The worm was soon identified as probably belonging to the genus *Lepidasthenia*, and was sent to Dr. Willey, of Colombo, who confirmed it in this genus, pronounced it without hesitation as a new and well-marked species, and kindly gave the description quoted verbatim at the end of this paper as the definition of the species.

In sending this definition Dr. Willey asked me to add my own observations and figures, and further remarked that the first pair of elytra required a special description. The first pair of elytra are about three times the size of the others, they are carried on peduncles which curve forwards and then inwards, so that the elytra of either side overlap, mid-dorsally, hiding the prostomium and the bases of the palps and antennæ. It will be noticed in fig. 1, that the second elytron of the right side and the second cirrus of the left side and their peduncles are missing.

This Polychæte was obtained in 25 fathoms of water about 30 miles west of Bushire.

In regard to the source of the phosphorescent lights observed, there can be no doubt that they emanated from the small elytra, but to say that the elytra were actually seen to be luminous would not be quite a true statement. The observation of the exact source of a phosphorescent light in such a case is a matter of great difficulty: to see the elytra it is necessary to examine the animal in a light so strong that the phosphorescence is inappreciable. The nature and distribution of the points of light described above agree exactly with the nature and distribution of the elytra, which were examined after the death of the animal. For this reason it is safe to assume that the light actually emanated from the elytra, and it is possible that all species of the genus exhibit this interesting phenomenon which was observed in this case merely owing to the happy chance of the animal being consigned to formalin late in the evening.

In order to make further observations on the phosphorescence of marine animals, the trawl was used twice this year at night in deep water, once off North Andaman Island in 235 fathoms, and once off Dondra Head, Ceylon, in 605 fathoms. The results of these stations may be enumerated as follows:—

STATION 374, OFF NORTH ANDAMAN ISLE, 235 FATHOMS.

Fish.

Macrurus investigatoris	1
Coloconger raniceps	2
Ateleopus indicus	1

Crustacea.

Nephrops andamanica	1
Aristeus semidentatus	1 male. 1 female.
Homola megalops	1
Pandalus alcocki	3 females. 2 males.
Pandalus martius	3
Munidopsis regia.	
Heterocarpus lævigatus.	
Squilla *sp.*	

Mollusca.

Xenophora pallidula.
Verticordea eburnea.
Two others unidentified.
A Decapod Cephalopod.

Hexactinellidæ.

Aphrocallistes beatrix.

Alcyonaria.

Pennatula pendula.

STATION 375, OFF DONDRA HEAD, CEYLON, 605 FATHOMS.

Fish.

Lamprogrammus niger.

Crustacea.

Heterocarpus alphonsi.
Polycheles phosphorus.
Nematocarcinus gracilis.

Mollusca.

Pleurotoma symbiotes *with its symbiotic* Epizoanthus
A small species of Dentalium.

Asterids.

A species of Hymenaster.

Among these twenty-four species only three showed phosphorescence. These were the prawns *Heterocarpus alphonsi* and *Pandalus alcocki*, and the Alcyonarian *Pennatula pendula.* Of these the Heterocarpus gave the most striking display of its illuminating powers, which have been already noted by a former "Investigator" naturalist (Alcock, *Ann. Mag. Nat. Hist.*, vol. viii, 1891, page 16). We, too, were able to observe all that this author described. While the prawn was in water the light floated away from its oral region in two streams which became extinguished about two inches from their source.

The property which the secretion has of retaining its illuminating power after leaving the body was well illustrated by the following occurrence: When the prawn was taken out of the bucket, the water, dripping from the animal, was so highly luminous that a bright phosphorescent stream flowed down the antennæ (which were five inches long) and dripped from their ends in globules of light that did not become extinguished until they intermingled with the water in the bucket.

The other prawn which showed the same powers, but to a rather less marked extent, was one of the five specimens of *Pandalus alcocki.* The other four, whose tissues must have been quite dead, showed no light. This proves that negative evidence is of no value in such observations.

The third species which showed light was the Alcyonarian *Pennatula pendula* (common in deep waters about the Andamans, but only recently described by Thompson and Henderson, *Investigator Alcyonarians*, part i).

This specimen merely showed faint evanescent light when disturbed, but when placed in formalin solution rows of brilliant light points at once appeared on its pinnules and remained in evidence for at least a minute before dying out. This brilliant display suggested the possibility of recording such phenomena by photography; and the idea of photography, involving as it does the use of a dark room, helped me to see that our dredging in the dark, a most inconvenient procedure, was also unnecessary. The same results could obviously be obtained by removing the specimens to a dark room, where any well-marked phosphorescence could be recorded by placing them in a bottle of formalin solution on which a camera with very sensitive plates had previously been focussed.

It is hoped that such experiments will be carried out in future. Nevertheless my thanks are due to Commander W. G. Beauchamp, R.I.M., for allowing trawling at night and for the skilful way in which it was carried out under his personal supervision.

DESCRIPTION OF A NEW POLYCHÆTE WORM.

Family APHRODITIDÆ.

Lepidasthenia stylolepis, Willey, sp. nov.

"All appendages glabrous except the palps, which bear rows of small blunt papillæ. Antennæ sub-equal, the median slightly longer than the lateral and less than one-third the length of the palps. Elytra very small, borne upon long peduncles, which are somewhat shorter than the parapodia. Notopodia obsolete, with acicula but without setæ. Neuropodial setæ (fig. 4) of the anterior segments (and perhaps of all when unworn) with filiform tips below which there is a deep bidentation, as well as subterminal serrulations. There are thirty-seven segments present in the specimen, which is incomplete behind. Segments with brownish transverse bands along the posterior border. Dorsum quite exposed, the elytra directed away from it, on their stalks. The first ventral cirrus as long as the parapodium, the rest very short. Dorsal cirri pigmented, some pale, some fallen off, borne upon long peduncles which are as long as the parapodia, the cirri being shorter than their peduncles.

Elytra on segments II, IV, V, VII, IX, ... XXI, XXIII, XXVI, XXIX, XXXII, XXXV.

Both cirriophores and elytrophores penetrated by a cæcal diverticulum of the gut arising from the latter by a very narrow pedicel, then widening out."

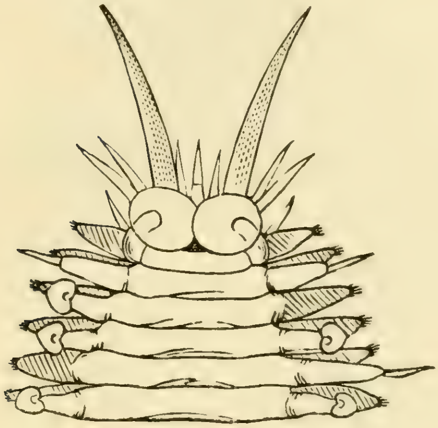


FIG. 1.—Anterior end of dorsal view of head and anterior segments. The left lateral antenna is shown too long.

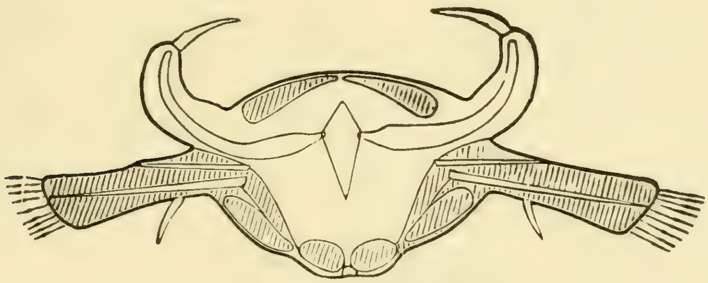


FIG. 2.—Segment bearing dorsal cirri.

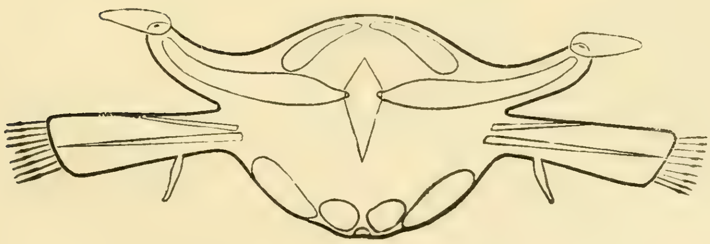


FIG. 3.—Segment bearing elytra.

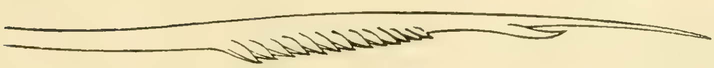


FIG. 4.—Neuropodial seta.

XXI.—NOTES ON THE RATS OF DACCA, EASTERN BENGAL.

By C. A. GOURLAY, *Captain, I.M.S.*

I forward these notes to the Indian Museum as a small contribution to a subject of considerable importance at the present day.

During the month of April, 1907, an attempt was made to gauge the relative numbers of different species of rats in Dacca. During the investigation, 1,045 rats were examined and of these 1,041 were identified.

611 proved to be specimens of *Mus rattus.*
430 ,, ,, ,, ,, *Nesokia bengalensis.*

No other species of rat was found. Thus of the rat population of Dacca, it appears that about 59 per cent. are *Mus rattus* and 41 per cent. are *Nesokia bengalensis.*

These specimens were trapped in houses, "kutcha" (mud) and "pucca" (masonry), and in grain godowns and grocers' shops in various parts of the town.

Of those	trapped in	"pucca" houses	68 %	were	*M. rattus.*
			32 %	,,	*N. bengalensis.*
,,	,,	"kutcha" ,,	57·7 %	,,	*M. rattus.*
			42·3 %	,,	*N. bengalensis.*
,,	,,	grocers' shops	55·3 %	,,	*M. rattus.*
			44·7 %	,,	*N. bengalensis.*
,,	,,	grain godowns	44·5 %	,,	*M. rattus.*
			55·5 %	,,	*N. bengalensis.*

Dacca is a city of over 90,000 inhabitants, with narrow streets, indifferent sanitation, a very imperfect system of surface drains, and only one short sewer. Many of the houses are "kutcha" throughout, and of the "pucca" houses many have earthen floors.

In all cases, measurements were taken in accordance with Hossack's instructions and the collection was divided into three series of about 350 specimens each. The first series is omitted from these observations as, presumably, the measurements (being those of a novice) are not so accurate as the later ones.

M. RATTUS.

It was found impossible to distinguish the varieties of *M. rattus* according to the descriptions extant. All sizes show colour variations and the only point on which one can dogmatise, is that *M. rattus*—the black rat—does not appear to be black in Dacca.

The following table shows the variations in size and the proportionate measurements of *M. rattus* as found in Dacca. Judging by the breast development in female specimens, it appears that maturity is reached when the rat is about 14 cm. in length. Of 53 female specimens under 14 cm. only one was found to have developed breasts.

Total length of head and body in cm.	Number of specimens.	PERCENTAGE TO LENGTH OF HEAD AND BODY OF		
		Tail.	Hind foot.	Ear.
Under 13 cm. ..	52	125·9	24·8	16·8
13 and under 15 cm. ..	67	123·9	22·7	15·5
15 ,, ,, 16 cm. ..	56	123·1	21·3	14·3
16 ,, ,, 17 cm. ..	87	122·4	20·1	14·1
17 ,, ,, 18 cm. ..	70	120·6	19·6	13·8
18 ,, ,, 19 cm. ..	31	117·3	18·6	13·1
19 cm. and over ..	12	114·6	18·2	12·4

An adult *M. rattus*, then, measures anything from 14 cm. to 20 cm. The largest specimens are old males, and are the only specimens with well-developed bristles in the fur.

The tail is almost always considerably longer than the head and body. The shortest tail in my collection is 102·37 per cent. of the body-length, and the rat measured 21·5 cm., so that it was a very old specimen.

Hind foot.—The sole is seldom uniformly purple. There is always some purple towards the "heel," but the fore-part of the sole is generally flesh-coloured. The pads are always six in number, the proximo-external pad being well developed. The median pads are cordiform.

Ear.—By measurement, the ear does not appear to be appreciably longer than that of a *Nesokia bengalensis* of the same size, but the setting is characteristic. The ear is "prominent, standing out clearly from the head."

Breasts.—In females, the usual distribution of the breasts is $\frac{2}{3}$. The most common variation (in 6 pe cent. of the specimens) is $\frac{3}{3}$. When this occurs, the third pectoral breast bears the same relative position to the second pectoral as the third inguinal bears to the second inguinal. The first inguinal breast is about 1·25 cm. in front of the second and the second is about ·3 cm. in front of the third.

Distribution.—Of all specimens of *M. rattus.*—

43·3 %	were	captured in	"pucca"	houses.
28·4	,,	,,	"kutcha"	,,
13·7	,,	,,		grocers' shop.
12·0	,,	,,		grain godowns.
2	,,	,,		streets, etc.

NESOKIA BENGALENSIS.

The following table shows the variations in size and the proportionate measurements of *Nesokia bengalensis* as found in Dacca. In this case also, judging by the breast development, it appears that maturity is reached when the rat is 14 cm. in length. Of 28 female specimens under 14 cm. none have developed breasts.

Total length of head and body in cm.	Number of specimens.	Percentage to length of head and body of		
		Tail.	Hind foot.	Ear.
Under 13 cm. ..	30	79·3	23·56	16·6
13 and under 15 cm. ..	39	79·15	21·35	14·5
15 ,, ,, 16 cm. ..	26	81·6	20·1	13·6
16 ,, ,, 17 cm. ..	40	81·7	19·8	13·29
17 ,, ,, 18 cm. ..	59	80	18·6	13·1
18 ,, ,, 19 cm. ..	43	80·3	18·2	12·5
19 ,, ,, 20 cm. ..	24	76·5	17	12·23
20 cm. and over ..	16	74·8	16·5	11·25

The adult *N. bengalensis* measures anything from 14 cm. to 21 cm.

Bristles appear in the fur of adults at all stages.

Colour.—The colour is iron grey or greyish brown.

Tail.—The tail is from 75—80 per cent of the length of the head and body, though it may be shorter in old specimens.

Hind foot.—The hind foot shows a regular gradation of proportionate measurements with the increase of age. The sole is purple throughout. The pads number five fully developed ones, and one (the proximo-external) which is rudimentary. In 9 per cent. of 56 *N. bengalensis* examined with special care, the proximo-external pad was absent. The median pads are frequently cordiform though smaller than in *M. rattus.*

Ears.—The ears, though in actual measurement not appreciably shorter than those of *M. rattus*, are more closely set on the side of the head. These also show gradually diminished proportionate measurement as age advances.

Breasts.—The commonest distribution of breasts was found to be $\frac{4}{4}$. This arrangement was found in 61·5 per cent. of the female specimens with breast development. In only 8·3 per cent. was the arrangement $\frac{4}{3}$ present. The arrangement is certainly much more variable than in *M. rattus*.

Distribution.—Of all specimens of *N. bengalensis*—

29 %	were	captured	in	"pucca" houses.
29·3	,,	,,	,,	"kutcha" ,,
15·5	,,	,,	,,	grocers' shops.
21·2	,,	,,	,,	grain godowns.
5	,,	,,	,,	streets, etc.

Most of these observations agree with those of Hossack in Calcutta. They confirm (1) the impossibility of separating varieties of *M. rattus* by size.

(2) The size at which maturity is attained, namely 14 cm. in both species.

(3) The diminution in the proportionate measurement of hind foot and ear in both *Mus rattus* and *Nesokia bengalensis*, and of the tail in *Mus rattus*, as maturity is reached.

On the other hand, I do not find the distinction between cordiform median pads in *Mus rattus* and circular median pads in *Nesokia bengalensis* holds good. The essential point of difference appears to me to be the rudimentary condition of the proximo-external pad in the hind foot of *N. bengalensis*. Again, Hossack gives the usual breast arrangement of *Nesokia bengalensis* as $\frac{4}{3}$. I find it is $\frac{4}{4}$.

XXII.—NOTES ON FRESHWATER SPONGES.

By N. ANNANDALE, *D.Sc., Officiating Superintendent, Indian Museum.*

I.—THE BUDS OF *Spongilla Proliferens*, MIHI.

The buds that form so characteristic a feature of this species arise as thickenings of the strands of cells accompanying the primary spicule fibres of the skeleton, which project outwards from the surface of the sponge. These thickenings originate beneath the surface and contain, at the earliest stage at which I have as yet examined them, all the elements of the adult organism (*i.e.*, flesh spicules, ciliated chambers, efferent and afferent canals, parenchyma cells of various sorts) except skeleton fibres, gemmules, and a dermal membrane. A section at this period closely resembles one of an adult sponge, except that the structure is more compact, the parenchyma being relatively bulky and the canals of small diameter.

As the bud grows it makes its way up the fibre, pushing the dermal membrane, which expands with its growth, before it. The skeleton fibre does not, however, continue to grow in the bud, in which a number of finer fibres make their appearance, radiating from a point approximately at the centre of the mass. As the bud projects more and more from the surface of the sponge the dermal membrane contracts at its base, so as finally to separate it from its parent. No aperture is left when this occurs, the membrane closing up the gap completely. The newly liberated bud already possesses numerous minute pores, but as yet no osculum; its shape exhibits considerable variation, but the end that was farthest from the parent sponge before liberation is always more or less rounded, while the other end is flat. The size also varies considerably. Some of the buds float, others sink. Those that float do so either owing to their shape, which depends on the degree of development they have reached before liberation, or to the fact that a bubble of gas is produced in their interior. The latter phenomenon only occurs when the sun is shining on the sponge at the moment they are set free, and is due to the action of the chlorophyl of the green bodies so abundant in certain of the parenchyma cells of this species. If the liberation of the bud is delayed rather longer than usual, numbers of flesh spicules are produced towards the ends of the primary skeleton fibres and spread out in one plane so as to have a fanlike outline ; in such buds the form is more flattened and the distal end less rounded than in others, and the superficial area is relatively great, so that they float more readily. Those buds that sink, usually fall in such a way that their proximal, flattened end comes in contact with the bottom or some suspended object, to which it adheres. Sometimes, however, owing to irregularity of outline in the distal end, the proximal end is uppermost. In this case it is the distal end that adheres. Whichever end is uppermost, it is in the uppermost end, or as it may now be called, the upper surface, that the osculum is formed. Water is drawn into the young sponge through the pores and, finding no outlet, accumulates under the dermal membrane, the subdermal space being at this stage even larger than it is in the adult sponge. Immediately after adhesion the young sponge flattens itself out. This process compresses the water in the subdermal space and apparently collects a large part of it at one point, which is usually situated near the centre of the upper surface. A transparent conical projection, formed of the dermal membrane, arises at this point, and at the tip of the cone a white spot appears. What is the exact cause of this spot I have not yet been able to ascertain, but it marks the point at which the imprisoned water breaks through the expanded membrane, thus forming the first osculum. Before the aperture is formed, it is already possible to distinguish, on the surface of the parenchyma, numerous channels radiating from the point at which the osculum will be formed to the periphery of the young sponge. These channels as a rule persist in the adult organism and result from the fact that the inhalent apertures are situated at the periphery, being absent from both the proximal and the distal ends of the bud. In the case of floating buds the course of development is the same, except that the osculum, as in the case of development from the gemmule in other species (see Zykoff, *Biol. Centralb.*, xii, p. 713, 1892), is usually formed before adhesion takes place.

The life of the individual is very short in *S. proliferens*, never lasting for more than a few weeks. So far as I have observed, sexual reproduction does not take place, but gemmules are produced in large numbers at the same time as the buds, often when the sponge is less than 100 sq. mm. in superficial area. A continuous succession of generations takes place throughout the year.

The above observations have been made chiefly on specimens in my aquarium in the Museum, but they have been corroborated, as far as possible, by a periodical inspection of others living in natural conditions in a pond.

Buds of a somewhat different nature are sometimes produced by *S. carteri* Bwk., and appear to be identical with the reproductive bodies described in *S. lacustris* by Laurent (*C. r.*, Sé. Ac. Sc. Paris, xi, p. 478, 1841) many years ago. With these I hope to deal on another occasion.

II.—Gemmules of *Trochospongilla phillottiana*, mihi.

In my original account of this species (*Journ. Asiat. Soc. Bengal*, 1907, p. 22) I stated that the covering of the gemmule was thin. An examination of numerous specimens has shown me that this statement was incorrect as regards the majority of examples, in which the coating of granular substance is thick but unevenly distributed. Viewed from the external surface, the gemmules appear to be covered with little pits. These coincide with the position of the gemmule spicules and are in fact funnel-shaped passages leading from the external surface of the gemmule to the outer rotula of each spicule. So characteristic and so constant does this feature appear to be that I am inclined to think that in the type of the species the gemmules were not fully developed. In my description of these gemmules "cylindrical" is a *lapsus calami* for spherical.

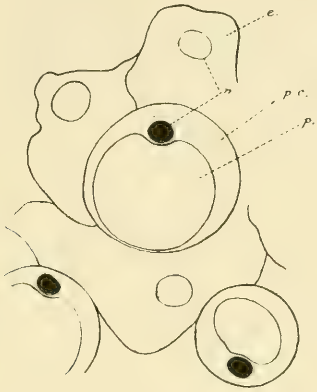
III.—Embryos of *Ephydatia blembingia*, Evans.

Dr. Richard Evans in his original description of this species (*Quart. Journ. Micr. Sci.*, 1901, p. 71) notices certain minute basket-shaped bodies lying in cavities in the sponge, and is inclined to regard them as examples of a parasitic species, although their spicules only differ from those of the adult *E. blembingia* in their small size. Dr. F. Harmer, of Cambridge, has recently sent me one of Dr. Evans's specimens, and I have been able, thanks to its excellent state of preservation, to examine these bodies. They appear to me to be embryos in different stages of development. The smallest consist of rounded masses of cells, which in some cases can be seen to be of two sorts, a number of smaller ones and several larger ones. The compressed form of the larger examples is probably due, as Dr. Evans himself suggests, to shrinkage in preservation. In their later stages the bodies lie in well-defined cavities in the sponge, each body being surrounded by a delicate membrane secreted by a layer of flattened cells that apparently belong to the parent sponge. The body itself consists of an external layer of columnar cells and of an internal mass containing a large cavity. The cavity is situated towards the narrower end of the body and is enclosed at this end by a thin layer of cells that mostly have a starlike outline. The main bulk of the mass is belo v the cavity and consists of cells of several kinds, amongst which may be distinguished spiculiferous cells bearing spicules that are smaller, as yet, than those of the adult sponge. In short, an optical section of the body, apart from the membrane in which it is enclosed, closely resembles the actual section of an embryo of *Spongilla lacustris* figured by Evans in fig. 9, plate xxxvi, vol. xlii of the *Quarterly Journal of Microscopical Science*, 1899. In his account of *Ephydatia blembingia* he says that he was unable to make out the exact structure of these bodies, because none of his sections passed through them. If, however, a small piece of the sponge is teased up, stained with hæmatoxylin, cleared and mounted, it is not difficult to see the structures I have alluded to, although this method of observation does not permit of a minute examination of the cell anatomy. I have found closely similar embryos in *Spongilla carteri* both in summer and in spring, and also in an indeterminate sponge (probably an *Ephydatia*) taken by Mr. H. C. Robinson and myself at Biserat in the Siamese Malay States in autumn. I am indebted to Dr. Evans for the opportunity of re-examining, in a critical manner, the latter specimen, which I had handed over to him before I took up the study of the freshwater sponges myself.

IV.—THE NATURE OF THE PORES IN *Spongilla*.

The exact nature and origin of the external apertures of the inhalent canals in the Demospongia has been much disputed. Several authors claim to have established the fact that these apertures are intracellular and that the cells which contain them are porocytes homologous with those of the Calcarea. This view has been opposed by Minchin and others on theoretical grounds. An examination of fresh and well preserved specimens of the species of *Spongilla* occurring in Calcutta has convinced me that the structure of the pores is variable even within the limits of this genus. Two types can in fact be distinguished in the species examined, while from the descriptions of other species it seems probable that they also exemplify one or other of these types. Before describing the different forms of pores it will be as well to state the methods of investigation adopted. I find that in a tropical climate the best preservative for the dermal membrane is absolute or nearly absolute alcohol. The cutting of serial sections is not a satisfactory method of investigating this part of the sponge under any conditions, and in a climate such as that of Calcutta is almost impossible. If the dermal membrane does not adhere closely to the parenchyma, a piece of it may be detached with a pair of needles, floated off, stained—I find Ehrlich's acid hæmatoxylin an excellent stain—and mounted for examination. In many species, however, it is difficult to remove a large enough piece of the membrane in this way, and in such cases I find the best method is to shave the surface of the hardened sponge with a sharp razor. A portion of the parenchyma usually adheres to the membrane thus removed, but this does not very much matter, as sufficient clear spaces remain for the purposes of examination.

The first type of pore is found in those species (e.g., *S. carteri*) in which the subdermal space is small and the pores correspond in position more or less exactly with the distal extremities of the canals. Such species have comparatively large pores and as a rule there is no projecting collar round the osculum. The pores are simply gaps in the membrane, being surrounded by cells which do not differ from the other epithelial cells of the membrane except that they are often slightly attenuated in a horizontal plane.



Outline of a small portion of the external surface of the dermal membrane of *S. proliferens*, showing flattened epithelial cells (*e c.*) and pores (*p.*), × about 1290. The membrane was taken from the edge of the sponge and stained with hæmatoxylin. The outline was drawn with a camera lucida and slightly enlarged. *n.* = nuclei ; *p c.* = pore cell.

In the majority of *Spongillæ* that occur in Calcutta, however, the pores can only be detected with the aid of a fairly high power of the microscope and open not directly into the termination of the afferent canals but into the subdermal space, their exact arrangement differing in different species. In such forms the subdermal space is often very large. Sponges which have this form of pore differ widely in other respects ; those with which I am best acquainted are *S. crassissima* and *S. proliferens*. In such forms the pore is as a rule surrounded by a single cell. The actual hole is almost circular ; the cell that surrounds it has a minutely granular cytoplasm and a small nucleus that stains very deeply. For the greater part of its circumference the cell is attenuated to a mere filament ; at the point at which the nucleus is situated it swells out considerably in both planes, while it is most attenuated at the opposite extremity. In all cases, so far as my observations go, the cell completely surrounds the pore, if only one cell is present, without a sign of secondary fusion at any point ; but the relative proportions of the cell and the pore differ considerably and in some cases the latter is nearly in the centre of the former. Without further information it would be impossible to escape from the conclusion that the pore was intracellular ; but even were this the case, it would not be necessary to assume that the porocyte was homologous with that of the Calcarea. Indeed, there is one important difference, *viz.*, the pore-surrounding cell in *Spongilla* is not contractile, and cannot close the pore. In some cases, moreover—in *S. crassissima* at any rate—the pore is not surrounded by one such cell, but by two. In such cases each cell is bent into a semi-circle, having a crescentic outline, and the two adhere together round the pore by their extremities. The nucleus and cytoplasm of such cells do not differ from those of cells that apparently contain an intracellular pore. I am inclined to believe, therefore, that even in the latter instance the pore is not really intracellular, but is surrounded by an originally crescent-shaped cell, the two ends of which have fused together. I have not been able to detect any trace of true porocytes in connection with the ciliated chambers in any species examined

V.—THE SYSTEMATIC POSITION OF *Ephydatia meyeni*, CARTER, AND *E. indica*, MIHI.

As these are the only species of the genus that I have been able to find in Calcutta, my conclusions as to their specific and generic identity, after examining a large number of specimens, may be useful to others studying the group. *E. meyeni* was described in 1849 by Carter, who in 1881 stated that he believed it to be a variety of the widely distributed *E. fluviatilis.* Weltner (*Archiv. f. Naturg.*, lxvi (1), p. 124, 1895), however, assigned it to *E. mülleri* (Liebk.). During the present season I have found a form that agrees closely with Carter's descriptions, growing in the Museum tank in Calcutta. Its gemmule spicules have long shafts with scattered spines, but their rotulæ are very irregularly serrated; as a rule the spicules surround the gemmules in two rows. The skeleton spicules are smooth and sharp, and although the skeleton is rather fragile, it is hard, and spongin webs can be detected at its nodes. An important character was necessarily passed over by Weltner, who had only examined a dry specimen of this form, *viz.*, the presence of large numbers of vesicular cells in the parenchyma. These agree closely with Weltner's figure (*Archiv. f. Naturg.*, lix (1), pl. viii, fig. 14) of a cell of this kind from the parenchyma of *E. fluviatilis*, and as their presence is recognized to be diagnostic of *E. fluviatilis*, I believe that Carter was right in regarding *E. meyeni* as belonging to this species; it should therefore be called *E. fluviatilis* var. *meyeni.* Very possibly *E. robusta* (Potts) from North America is identical with this form.

E. indica, described by myself in 1907 (*Journ. Asiat. Soc. Bengal*, 1907, p. 20) is an interesting form as being to some extent intermediate between the genera *Ephydatia* and *Spongilla.* Even in the best developed specimens the rotulæ of the gemmule spicules are small and inconspicuous, consisting merely of a ring of spines but little differentiated from those that occur on the shafts. The spicules are arranged, however, in the upright position common in gemmules of *Ephydatia*, and the whole appearance not only of the gemmules but of the sponge itself resembles that of other species of this genus. Numerous specimens were obtained by Mr. R. Kirkpatrick and myself in a tank on the Calcutta maidan in May last. On examination these specimens proved to differ in several points from the types of the species. In the first place, the skeleton spicules were sharply pointed and distinctly inflated at the ends and sometimes in the middle, closely resembling those of a form found by Hanitsch (*Irish Naturalist*, 1895, p. 128, pl. iv) in Ireland and provisionally referred by him to *E. crateriformis*, Leidy. The gemmule spicules, moreover, were not or barely birotulate; the majority of them ending in a sharp, stout, vertical spine surrounded by a ring of transverse spines barely to be distinguished from those on the shaft. The spicules were, however, placed upright in the coat of the gemmule, and although many of the latter were still immature, some of them appeared to be fully formed. Large numbers of similar spicules occurred scattered in the parenchyma, and I also found a few free spicules of an irregularly massive outline. In July I obtained fresh specimens from the same tank and submitted them to a careful examination. In these examples the majority of the gemmules were fully formed, their spicules being distinctly birotulate and agreeing with those of the type of the species. The skeleton spicules were no longer pointed and expanded at the ends, although their outlines were still rather irregular, but closely resembled those of the type. Numerous free birotulates were found in the parenchyma. From this I conclude that the specimens found in May were immature, and that their peculiarities were due to their immaturity. *E. indica* is, as I suggested in my original description, closely allied to *E. crateriformis*, but the aperture of the gemmule is situated on a distinct prominence and is not markedly crateriform.

MISCELLANEA.

MAMMALS.

THE ORIGINAL HOME OF *Mus decumanus*.—In a previous paper on the rats of Calcutta (*Mem. Ind. Mus.*, vol. 1, No. 1) I called attention to a paper by De l'Isle on the existence of a northern negroid race in the Brown Rat (*Ann. Sci. Nat.* (5), Zool., 1865, pp. 172-222). As my memoir was already in the press before I discovered this paper, I had to content myself with a brief note on the identity of the Indian and European forms of *Mus rattus*. A fact that caused me some doubt all through the writing of the descriptions of the rats of Calcutta was that *M. decumanus*, as observed by me in Calcutta and as exemplified by the collection of skins from different parts of India in the Indian Museum, is characterized by a distinct though variable paleness of the lower surface of the tail, whereas in Great Britain the whole tail is of one colour. De l'Isle puts forward a theory which, though it is open to objection on some points, seems to afford a satisfactory explanation of this observation of mine, and to throw light on the problem of the original home of *M. decumanus*. His theory, briefly, is that the original wild form of *Mus*, as exemplified both in *M. sylvaticus* and *M. alexandrinus*, has the underparts white or of a light colour and the tail bicoloured (although in the case of *M. alexandrinus* the tail is of a uniform pale brown); but that the corresponding parasitic forms, namely *M. musculus* and *M. rattus*, which have attached themselves to man and have therefore freed themselves from the necessity of protective coloration to some extent, have become dark below and have developed uniformly dark tails. The second part of his theory is that the change is also due in part to climate, and that under the grey skies of the north the clear and sharp differentiation between the upper and the lower surfaces tends to disappear, and a uniform coloration to be produced. The most marked instance of this is, he says, to be found in *M. rattus*, the northern offshoot of the Oriental wild parent form *M. alexandrinus*. In reference to the climatic change in *M. decumanus* he merely cites the deviation from type described as *M. hibernicus*, an occasionally black variety found in the British Isles. In reference to the change in this rat due to parasitism, he writes as follows :—

" A parasite like the rat (*M. rattus*) or the mouse (*M. musculus*), and like these species of Asiatic origin, the Brown Rat (" surmulot "), which was only introduced into France towards the middle of last century, already exhibits very evident traces of alteration in colour. Thus one frequently meets with individuals that have the under-surface no longer whitish, but ash-coloured, with scattered blackish hairs, and the tail *not* of two colours, white below, as in the type of the species, but uniformly blackish grey."

Before discussing the pros and cons of De l'Isle's theory, it may be pointed out that he recognizes *M. decumanus* as a rat of eastern origin characterized by having a tail of two colours. Its most extreme departure from type, as found in the melanotic form known as *M. hibernicus*, he believes to be due to climatic environment; the minor alterations, shown mainly in the darkening of the under-surface of the tail, he credits, on the other hand, to the effects of parasitic life. Though this theory is a fascinating one, it is not to be accepted without reservations, and there are points in it to which exception may be taken, especially in view of the facts and observations recently collected. The strongest point in its favour is that what he describes as the "wild" type of coloration is almost universal in wild animals of every sort and is now well known to have great protective value. In favour of the climatic part of the theory is the fact that in Calcutta, although I have examined thousands of specimens, I have never come across one that showed a tendency to general melanosis, but have frequently noted the ashy grey belly which he quotes as an instance of the parasitic type of coloration. The strongest argument against the whole theory is that he assumes that the typical form of *M. alexandrinus* exhibits what he calls the "wild" type of coloration. This is probably far from being the case, for Liston has shown that no less than 20 per cent. of the rats of Bombay are black, while here in Calcutta, while black rats are rare, nearly half of the specimens I have collected have grey or orange-grey bellies. *Mus decumanus*, if of eastern origin, should be wild in the East, but I have come to the conclusion that it is even more strictly parasitic on the banks of the Hughli than it is on the banks of the Thames. In Bengal, and in India generally, it is hardly to be found except in seaports and, occasionally, on the banks of the great navigable rivers that debouch at these ports; in the interior of Bengal and Assam, as I learn from Capt. Gourlay, I.M.S., and others, it is practically unknown. Why should this be if it is living nearer to its original home than in Great Britain? Again, if reliance is to be placed on De l'Isle's theory of parasitic versus "wild" coloration, it might be expected that *Nesokia bengalensis*, which in Calcutta is a parasitic rat, would show a marked difference when living under purely natural conditions. So far as I know, it shows no such difference. Doubtless this is one of the points that will be taken up in the proposed survey of the rats of India. Another point worthy of investigation would be the question whether *Mus rattus* exhibits a greater tendency of "wild" coloration when living in trees than it does when living in human habitations.

W. C. HOSSACK.

COLOUR CHANGE IN *Hylobates hoolock*, HARLAN.—It is generally believed that the variation of colour to which this species is subject is more distinctive of the female than of the male sex, and that age is the chief factor in colour change. These deductions are evidently based upon inadequate observations. Examples of black male and grey female hoolocks, or black males turning light-coloured on arriving at maturity are well known, but these facts prove nothing, as contrary cases of black female and grey male hoolocks are equally well known.

Observations on the numerous hoolocks (*H. hoolock*) obtained from Assam, Sylhet, Cachar, Manipur, the Chittagong Hill Tracts, the Irrawady Valley, and Arracan, and exhibited in the Calcutta Zoological Garden during the last thirty-one years and more show that, considered in relation to the variation of colour, the species may be divided into the four following groups :—

(1) Light-coloured female hoolocks turning grey, or even white with age.
(2) Black, or grey-coloured female hoolocks, becoming lighter grey or white with age.
(3) Black female hoolocks never turning grey or white.
(4) Light-coloured, or grey males, remaining always the same colour.

The following three specific cases may be mentioned in reference to groups 2, 3 and 4 respectively :—

1. "Maria," an adult black female, which had been for some years in captivity but had enjoyed very considerable liberty, was sent to the Garden in 1902. Her colour was not so intense at the time as that of some black individuals, and she has gradually become paler since it was necessary to cage her owing to her temper. At present (July, 1907) the hair on her back, on the outside of her limbs, on her face (except the eyebrows, which remain pure white) and on the inside of the forearm and lower leg is of a very pale, brownish grey colour, while the ventral surface of her body and the inside of the upper leg and arm is of a pale but rather warm purplish brown. The hair on the hands and feet is white. The pigment of the skin has not been affected.

2. An adolescent black female hoolock came into the possession of the Garden early in 1895, and was placed in the house usually occupied by the anthropoids. Accustomed as the animal was to a life of comparative freedom, it took to pining and became seriously ill. Careful nursing and treatment having failed to bring about any change for the better, it was set at liberty. The effect was marvellous, the animal soon recovered, and, having regained its usual cheerfulness, enjoyed life for the next seven years, roaming about far and near, but always returning to the Garden at the appointed hours of feeding. It never turned grey, not even light coloured.

3. In 1878, a young male of a greyish brown colour was acquired from Assam. The late Dr. John Anderson, F.R.S., then Honorary Secretary of the Garden, was particularly interested in the animal, as he was anxious to determine whether it became black as it grew older. It lived for several years in the Garden, and

died long after arriving at maturity, but never showed any sign of changing from grey to black.

The following extracts from a letter from Mr. E. Stuart Baker may throw further light on the subject of colour-changes in hoolock gibbons :—

"Susan, a female gibbon got by me as a mature animal, was sent to Colonel Vaughan, I.M.S. . . . . Colonel Vaughan kept her for some time and then passed her on to a Captain (now Colonel) Johnstone, and he again to others, and when I saw her many years later she was still jet black. A very large adult grey ♀ belonged to a Mr. Lewis Jones in North Cachar. It was caught as a grey *butcha* (young one) and remained the same colour, in this case a dark grey, all the time I knew it. I have kept many black hoolocks, in one case from a few days old until it was seven or eight years old, and never have I seen any change of colour take place."

Mr. Stuart Baker, who has considerable experience of Assam hoolocks in their wild state, has often seen the same small community of hoolocks to contain white, brown, and black specimens, and these seemed to him always to remain the same.

The late Mr. Louis Schwendler, who will always be remembered in connexion with the establishment of the Calcutta Zoological Garden, related to me the following facts about a pet hoolock of his, a *female of a jet black colour*. She broke her arm by a fall from a tree and had to be kept in close confinement for over six weeks. During this period of enforced captivity she lost her black colour, and became almost grey. Change of hue, brought about by illness or injury, has been known to occur in other species of monkeys—particularly in *Semnopithecus pileatus*, and *Macacus arctoides*.

R. B. SANYAL, *Rai Bahadur*.

BATRACHIA.

EGGS OF *Tylototriton verrucosus*.—Mr. R. Hodgart, Zoological Collector in the Museum, while collecting Batrachia at Kurseong (5,000 feet) in the Darjiling district, recently (July, 1907) found several breeding females and eggs of this, the only Indian Urodele. Before describing the eggs I may notice a curious observation he made as regards the adult. He found that if it was grasped in the hand by the body it lashed about vigorously with its tail and drew blood from the hand. An examination of his specimens shows that the dorsal ridge is, at the base of the tail, exceedingly sharp and has a stiff and inflexible character. I have no doubt that this was the weapon used. Unfortunately the eggs, from one of which a larva is in the act of escaping, are not in a very good state of preservation, but the following particulars may be noted. They were found in small pools of rain water in an open wood and were attached together in pairs, each pair being separate from the others and not fixed to any external object. The eggs appear to have measured about 10 mm. in diameter and are spherical; they have an outer covering of comparatively loose jelly, the inner covering that contains the larva being more tenacious and having a greater density. The escaping larva measures 9 mm. in length—of which 3 mm. is occupied by the tail—and 1·75 mm. in greatest depth; its body is rounded owing to the large amount of yolk held in the belly, but its tail is laterally compressed and has a lanceolate outline. The head is small and round, measuring 1·5 mm. in length; the eyes are large but not protuberant; they appear to be covered with skin, but the eyeball can be detected externally. There are four delicate external gills on either side, each set being arranged in a graduated series from above downwards. The mouth is open externally and is transverse and relatively large; behind it there is a conspicuous fold of the body-wall. The anus is still imperforate. The belly is white, but the tail and the back and sides of the body are grey, with large black pigment-cells forming almost a reticulated pattern.

N. ANNANDALE.

CRUSTACEA.

THE HOSTS OF *Tachæa spongillicola*, STEBBING.—This Isopod, recently described by the Rev. T. R. R. Stebbing (*Journ. Linn. Soc.*, Zool., xxx, p. 39, 1907) from Calcutta, was first found in small numbers in *Spongilla carteri*, but, owing to a misapprehension, the author of the species suggested in a footnote to his description that it might have come from a form of *S. lacustris*. This misapprehension was due to a letter of my own in which I intended to refer to a very different Isopod found in *Spongilla alba* at Port Canning. During the present summer, however, I have found numerous specimens of *Tachæa spongillicola* in *Ephydatia indica*, so that it is evidently not confined to one host. *Ephydatia indica* is a sponge often found on the bottom of tanks, growing most commonly on the roots of water-plants. Possibly this habit may explain the abundance of the Isopod in its canals; as the latter is rare in *Spongilla carteri*, which generally grows near the surface but has very much wider apertures and canals than any other species common in Calcutta.

N. ANNANDALE.

A SECOND SPECIES OF *Dichelaspis* FROM *Bathynomus giganteus*.—The Indian Museum is fortunate in possessing a fine series of specimens of the giant deep-sea Isopod *Bathynomus giganteus*, Milne-Edwards, and Barnacles of the genus *Dichelaspis* occur on the pleopods in every case. I recently described examples of these Barnacles from a specimen from the Arabian Sea as the types of a new species, *D. bathynomi* (*Ann. Mag. Nat. Hist.* (7), xvii, p. 46), and others from specimens from the Andaman Sea and off the Madras coast agree with them. Those on another specimen, however, from off Ceylon, closely resemble *D. occlusa*, Lanchester, a species described from *Thenus orientalis* from shallow water on the east coast of the Malay Peninsula (*Proc. Zool. Soc.*, 1902, p. 373). As my specimens are evidently immature, I am unable to decide whether they are merely a variety of this species or specifically distinct. The points in which they differ from Lanchester's specimens are the following: (*a*) the penis is extremely short; (*b*) the carina extends upwards a little further and is not so markedly produced at its lower extremity; (*c*) the tergum is larger, more nearly transverse and not so deeply notched at the point where the occludent segment of the scutum meets it; (*d*) the capitulum is more regular in outline and is not produced above the aperture into a lobe; (*e*) the valves are transparent and feebly calcified except immediately round the umbones of the scuta and terga; (*f*) no chitinous points are visible on the peduncle even under a high power of the microscope. Although these differences are numerous, the majority may be due to extreme immaturity on the part of the specimens from *Bathynomus*. The depth at which the latter was taken, *viz.*, between 225 and 594 fathoms, is, however, very different from that at which Lanchester's examples were collected.

N. ANNANDALE.

XXIII.—*NUDICLAVA MONOCANTHI*, THE TYPE OF A NEW GENUS OF HYDROIDS PARASITIC ON FISH.

By R. E. LLOYD, *M.B., B.Sc., Captain, I.M.S., Surgeon Naturalist, Marine Survey of India.*

While examining some tow net material collected in 1897 from the Andaman Sea by the naturalist of the R.I.M. Survey Ship "Investigator," my attention was arrested by a small fish, to the side of which was attached a curious lobulated growth. The fish (plate xvi, fig. 1), which measured only 18 mm. in length, was one of a number of specimens belonging to the species *Monocanthus tomentosus*, recently recorded by Johnstone from Indian seas for the first time (1). A portion of this growth was detached, stained and mounted. On examining the specimen microscopically, the following details were noticed (fig. 2) :—

(1) The most conspicuous feature was the presence of a large number of elongated club-shaped bodies, much resembling the contracted hydranths of *Clava* or *Coryne*, but entirely devoid of tentacles.

(2) At the base of these bodies, usually one to each, were a number of small globular objects. These, from the type of their structure and contents, were at once recognised to be closed gonophores or sporosacs.

(3) These structures arise from a basal plate, which is attached to the skin of the fish. This plate consists of a labyrinthine system of irregular spaces and tubules.

As a result of this preliminary examination, the growth was recognised to be most probably a hydroid colony of new type. Other small portions were detached and mounted, others again were cut into serial sections. Although the amount of material was very limited, and its state of preservation none of the best, yet it was found possible to elucidate the principal features of its structure. The material being so limited in quantity, in order to obtain sections of the male gonophore, it was found necessary to carry out the following procedure : A small portion of the growth was lightly stained and mounted *in toto* ; as this showed some good examples of the male gonophore, and no further material was available, the slide on which the specimen was mounted was placed upright in xylol. After a few hours the cover-glass became detached by its own weight, leaving the specimen adhering to the slide : the specimen itself soon after fell away from the slide. After soaking it freely in fresh xylol for about six hours it was imbedded in paraffin and cut into sections. Sections so obtained seemed quite as good as others, treated in the usual way. Owing to the heat of Calcutta, high-melting paraffin had to be employed in making these sections. Portions of the colony were placed in paraffin of 55° C. melting point for half an hour; this interval of time was found to be long enough for complete penetration.

The Hydranth—

Each hydranth is a club-shaped body measuring about ·75 mm. in length in the contracted state. In internal structure it differs remarkably from other hydroid colonies, but it seems difficult to arrive at any other conclusion than that the form in question is a hydranth and part of a hydroid colony. It resembles the genus *Protohydra* (2) and the parasitic *Hydrichthys mirus* (3) in that it is entirely devoid of tentacles or any trace thereof; but apart from this, the internal structure, as seen in sections, shows some most unusual features.

The ectoderm is relatively thin and, owing perhaps to want of proper fixation, does not show much structure. The appearance it presents in section is that of a somewhat irregular layer of protoplasm, containing a single series of nuclei (plate xvii, figs. 1 and 4). This layer is easily distinguished from the mass of endoderm cells, which show peculiar structural features. Careful search failed to demonstrate the presence of nematocysts in this ectoderm.

The endoderm is, in these contracted specimens, very much lobulated, so that the central cavity, which can be clearly made out both in optical and actual section, usually takes a sinuous course. The opening of the central cavity at the distal end of the hydranth can be clearly seen, and there is usually a slight external depression at its site. The endoderm cells, which make up the bulk of the hydranth, are of a peculiar structure: they are ovoid or spherical and have well-defined outlines. After staining with hæmatoxylin a nucleus cannot be demonstrated in them, but each cell contains a large number of small spherical granules, arranged round the periphery with great regularity. These granules take the stain exactly like nuclei, and they are probably composed of chromatin and perform the functions of nuclei. These large cells do not actually line the central cavity, but are separated therefrom by a pavement epithelium—a single delicate layer of flat cells in which nuclei are easily demonstrable. This epithelium not only lines the central cavity but is continued outwards through the mass of the spherical cells and joins the peripheral ectoderm. Where it lines the central cavity, this epithelium is composed of one layer of cells, but where it passes out to join the ectoderm it is, like a mesentery, composed of two layers. This is clearly seen on examining favourable sections under a $\frac{1}{12}$-inch objective (fig. 4). As shown in figs. 1 to 3, the endoderm of the hydranth is divided by this epithelium into two separate parts.

The bilateral symmetry thus established is further emphasized by the presence of what appears to be a strand of muscle-fibres which occupies the central axis of each half. These fibrous strands are clearly seen in both longitudinal and transverse sections. They commence below, in the very base of the hydranth, which is largely made up of them, and pass upwards through the spherical cells of the endoderm nearly to its apex. Throughout their length they distribute fibres among the peripheral endoderm cells in the manner shown in figs. 3 and 4. Under a $\frac{1}{12}$-inch objective longitudinal sections of these structures show a fibrillated appearance which is well defined, and the individual fibres can be seen distributed between the spherical endoderm cells. These fibrils do not show nuclei. There can be little doubt that they have a muscular function.

The simple arrangement shown in the transverse section (fig. 1) in which the hydranth is divided into two separate halves, each of which contains a muscle-strand, was found in the proximal part of every individual examined in section, but in their distal parts the number of these "mesenteries" is increased. Some sections show three, others four or more. Figure 2 is of a somewhat oblique section showing four such mesenteries. At the base of the hydranth the specialised endoderm ceases abruptly in a sharply-defined line, which can be readily seen in optical section (pl. xvi, fig. 4). The central cavity is continued below into a tube of small dimensions composed of somewhat delicate cells. This tube, which usually has the form of a dice-box, its calibre being smallest in the middle of its length (fig. 4), opens into a long straight tube with thick walls composed of regular columnar cells. The other end of this straight tube opens into one of the irregular endodermal spaces of the cœnosarc.

The Basal Plate or Cœnosarc—

The basal plate is so closely attached to the skin of the fish that on removing a portion of it an outer layer of the fish's skin is often detached with it. In structure the plate is not the same throughout its whole extent. As a whole it is very like the attachment plate or cœnosarc of *Hydractinea* (4), but without the strong chitinous element so characteristic of that genus. Throughout most of its extent it is composed of two layers of ectoderm widely separated by irregular tubules and spaces with endodermal walls which communicate with one another freely and form a complex labyrinthine structure. The outer layer of ectoderm does not everywhere pass over this endodermal labyrinth in a smooth and unbroken fashion, but dips down between the layers of endoderm in places, and occasionally the cuticle is carried along with the ectoderm into the same situation. Although most of the cœnosarc has this complex structure, parts of it show the more primitive type consisting of an open meshwo k of irregular trabeculæ, each of which is a tube composed of two layers—ectoderm and endoderm with an external cuticle.

Considerable difficulty was experienced in interpreting the structure of the basal plate, for although the histological detail was fairly well preserved, there was little or no difference in the appearance of the endodermal and ectodermal layers; both varied in thickness, to a great extent, in different parts. Figure 5 (pl. xvii), which was drawn with the camera lucida from a favourable section, shows the principal features in the structure of the cœnosarc. It will be noticed that the cuticle is relatively very thin, in some parts of the colony it is hardly recognisable.

Gonophores—

The colony shows both male and female gonophores. With hardly an exception, one gonophore is situated at the base of each hydranth. Careful examination shows, however, that the endodermal layers of the gonophores are not directly connected with the endodermal canal at the base of the hydranth, but spring from the irregular endodermal spaces of the neighbouring cœnosarc. This is shown in pl. xvi, fig. 4. The gonophores are of the closed type known as sporosacs. They show no traces of tentacles, radial canals or ectodermal invagination.

The female gonophore was only studied in optical section, but as its structure was much simpler than that of the male ones, a comprehensible plan of the structure can be made out after study by this means alone. Figure 5 shows the principal features of the structure of these organs. They are spherical bodies, measuring ·17 mm. in diameter, and are each attached to the cœnosarc near the base of a hydranth. Their endodermal contents, which arise from the cœnosarc and not from the special endodermal canal of the neighbouring hydranth, split into two layers on entering the gonophore. The outer of these layers forms an uninterrupted sheet, closely applied to the ectoderm ; the inner forms a spadix of characteristic shape. This spadix, the walls of which are, by invagination, composed of a double layer of endoderm, forms a globular body separated by a considerable space from the wall of the sporosac. There is an opening in one side of the spadix due to the invagination, so that in longitudinal sections it forms a characteristic C-shaped figure. Developing ova can be seen between the layers of the spadix : in at least two cases ova of larger size than the others can be clearly seen in the canal of the neck of the spadix. Perhaps this is a preliminary position before the ovum passes into the central cup-like hollow. When the surface of a large ovum is examined under a high power of the microscope, it shows a delicate hexagonal pattern, caused by the approximated ends of the long columnar cells of the spadix pressing on it. Ova more advanced than the one shown in fig. 5 were not found.

The male Gonophores—

While the part of the colony seen in fig. 3 showed female gonophores chiefly, other parts showed the male form. This is of about the same size as the female gonophore, but is shaped like a pointed fir cone; it is more opaque than the female one, and consequently can only be properly studied in serial sections. Figures 6 to 8 show three of a series of such sections. The endodermal contents are more complex than those of the female form and do not seem quite the same in every case, but like that form there is a spadix which shows a more or less C-shaped figure in longitudinal section. No male gonophore was met with in a ripe condition; they mostly contained spermatoblasts.

Theoretical considerations—

In spite of the anomalous structure of the hydranth, this genus should, I think, find a place among the gymnoblastic hydroids, and a comparison with two hydroid genera, *Hydrichthys mirus* and *Stylactis minoi*, which are also parasitic on fish, leads to some interesting conclusions.

Stylactis minoi was described by Alcock in 1892 (5) and has been since found several times in Indian seas, always attached to the skin of the small rock perch *Minous inermis*. It is a typical hydroid in every way.

The peculiar form *Hydrichthys mirus* discovered in 1887 by Fewkes growing to the carangoid fish *Seriola zonata* at Newport, U.S.A., cannot be called a typical hydroid. It resembles the present genus very closely in some respects, in others it differs widely from it. *Hydrichthys* is described as follows by its discoverer:—

"The base of attachment to the fish is a flat, thin plate with ramifying tubes, by means of which the colony is fastened to the fish, and upon it separate clusters of sexual bodies (gonosomes) and filiform structures (hydranths ?) are united together."

The author compares this basal plate to that of *Hydractinea*, without the chitinous projections, and it is obviously very like that of the genus described here. *Hydrichthys*, however, has long arborescent gonosomes to which medusæ in all stages of development are attached. The fish, with its parasite, was kept alive in an aquarium and "thousands of these medusæ were raised." The medusæ swim freely, and each has four tentacles. The generative organs are therefore totally different from those of the new genus, in which these organs are represented by a few closed sporosacs, sessile on the basal plate. Turning now to the hydranth, the comparison between the two forms is of such interest that it seems well to quote Fewkes's account *in extenso*, especially as the nature of the hydranth of *Hydrichthys* is regarded somewhat doubtfully by that author:—

"In addition to the botryoidal clusters of gonosomes there also arise from the basal plate by which the colony is fastened to the fish, long, flask-shaped bodies, recalling in their external form the tasters of the Siphonophores. These bodies, like the gonosomes, arise from the upper walls of the basal plate of tubes attached to the body of the fish. Like the gonosomes they are numerous in the hydroid colony. The filiform bodies are elongated flask-shaped structures, of about uniform size throughout, arising from different points of attachment at the base from the gonosomes They are, like the gonosomes, destitute of appendages, but they probably have an opening at the free extremity. The walls of the filiform bodies are composed of an outer thin and an inner thickened layer. There is a cavity within. The walls are dotted with pigment spots, which are especially numerous around the free extremity. In one of these filiform bodies there is a spherical mass, which resembles half-digested food. It is doubtful whether this mass is food. The free end of the filiform bodies is sometimes trumpet-shaped, but ordinarily rounded, the opening being concealed by the contraction of the lips. The bodies of the filiform structures move backwards and forwards on their attachments, and are sometimes spirally coiled in a single turn. They recall in general appearance the spiral zoöids of Hydractinia and the tasters of Siphonophora, but, unlike either of these structures, have an orifice at their free end. They are thought to have close likenesses to the ' central polyp ' of Velella."

The difficulty of interpreting the nature of the flask-shaped bodies of *Hydrichthys*, becomes lessened in the light of the new genus *Nudiclava*; and the present writer is strongly of the opinion tnat the flask-shaped bodies of the former and the club-shaped bodies of the latter are both hydranths devoid of tentacles. Furthermore, that it is by means of these hydranths that the colonies obtain their food. In his description of *Hydrichthys*, the author expresses the following view of its mode of nutrition, a view expressed, necessarily at that time, somewhat doubtfully :—

" The absence of tentacles, or organs the function of which is the capture of food, would seem to deprive *Hydrichthys* of those means of capturing and drawing food to the mouth which are almost universal among fixed hydroids. Possibly in its parasitic life the hydroid obtains its sustenance from the fish on the sides of which it lives."

The close resemblances in the structure of the two forms now under comparison make it most probable that, whatever the mode of nutrition, it is of a similar nature in both cases. It seems from the following observations, that the genus *Nudiclava* does not obtain sustenance from the fish to which it is attached. It was previously mentioned that on removing a portion of the colony, an outer layer of the fish's skin was removed with it. Part of this was separated from the hydroid and examined microscopically ; it was found to be quite intact ; there was no sign of perforation by any radical organs. In the absence of any such special organs, it does not seem likely that the fish would be so accommodating as to diffuse nutriment, uncompelled, through its own skin into the tissues of the hydroid.

How, then, do these colonies obtain their food ? The assumption is made here, that *Hydrichthys* and *Nudiclava* obtain nutriment in the same way. The absence of tentacles in these parasitic hydroids deprives them of the power of catching their prey in the manner common to all other hydroids. Their mode of life is identical in both cases. Both were found adhering like a tuft to the skin of small fishes which were caught near the surface of the sea. Judging from Fewkes's well-executed illustration of the fish with its parasite, the superficial appearance of both would be very similar.

From the relatively large size of the hydranths of *Nudiclava* it is difficult to suppose that they are degenerate bodies of little functional value to the colony. The peculiar features of the endoderm of *Nudiclava*, the well-developed muscle strands, and the special pavement epithelium lining the central cavity, suggest that the methods by which these hydranths obtain food is as follows :—

It is supposed that in their natural state, they assume, by expansion of the mouth, the shape of a wide-spreading funnel (pl. xvi, fig. 2). As the host speeds through the surface waters, the small members of the plankton, such as copepod nauplii, etc., must come within the grasp of these funnel-shaped mouths. The well-developed muscles, situated in the endoderm, which are peculiar to the genus, point to a special power of rapid and forceable retraction, an act which would be very necessary when anything comes within the grasp of the funnel. The special pavement epithelium is perhaps developed as a protection and covering to the endodermal cells which would otherwise be exposed to the water, when the mouth is gaping widely.

We can illustrate the possible efficiency of this mode of food-capture thus : It is not unlikely that the hydranth, which measures ·75 mm. in length when completely contracted, could expand its mouth into a circle ·5 mm. in diameter The hydranths in the colony, which number about 50, would together present an area of about 10 square mm., which is at least as great as that of the gaping mouth of the fish host itself.

In the case of *Hydrichthys*, the hydranths, from their size, must also be considered important members in the colony. And there is some evidence in Fewkes's account that it obtains its food in this manner. Thus we read above, that the free or oral ends of the filiform bodies of this genus are sometimes trumpet-shaped, and one of these bodies contained a mass resembling food. *Hydrichthys* was kept alive in an aquarium for some time, but it would have been impracticable to examine the colony without catching the fish, a procedure which would cause at least partial contraction of the parasite : consequently it would be very difficult to observe the state of the oral apertures in their expanded condition, and the fact that some few were observed to be trumpet-shaped, makes it most likely that all would possess, in their expanded condition, a wide funnel-shaped mouth.

Let us pass now to a consideration of the third genus of hydroids which is found on fish. The case of *Stylactis minoi* on the fish *Minous inermis* is quite different from that of the others. The hydranth has a well-developed circle of long tentacles and a hypostome, and clearly catches its food like other hydroids. The hydrophyton is in the form of a creeping stolon which may almost entirely cover the fish. These differences point to a different mode of life from the other parasitic forms. An explanation of these differences seems to be found in the different nature of the fish. *Minous inermis* has been found many times in the Bay of Bengal in company with such teleostean genera as *Uranoscopus*, *Platycephalus*, *Lophius*, *Pterois*, which are essentially bottom fish: whereas the fish hosts of the other two genera under discussion were both captured in the tow net. The extent to which the Minous is coated with the hydroid growth, caused its discoverer to hold the opinion that the hydroid must benefit the fish by concealing it to some extent. On this assumption, we can imagine the Minous remaining still for considerable periods of time during which the *Stylactis* could pursue its vocation of catching prey, in the fashion of other hydroids which are attached to rocks.

We see, therefore, that whereas the modes of life of *Hydrichthys* and *Nudiclava* seem essentially similar, they both differ considerably in this respect from *Stylactis minoi*: although all three forms appear to be hydroids parasitic on small teleostean fish.

Affinities—

Comparison with other more normal hydroid types has not led to any definite conclusions as to which particular type this new genus may have been derived from. It undoubtedly resembles the abnormal genus *Hydrichthys* in some ways, in the structure of the basal plate and the absence of tentacles, and in its mode of life generally. Here the similarity stops, and the two genera are separated by the great differences in the gonophores, and in the internal structure of the hydranth, which in *Hydrichthys* is quite of the usual hydroid type. The conclusion arrived at is that the similarities have been acquired in adaptation to the circumstances of the peculiar life which are alike in both cases; while the differences are due to the fact that the ancestors of both forms which took to this parasitic life were essentially different, especially as regards the nature of the gonophores. The genus *Nudiclava* has, however become more specialised than *Hydrichthys*, as the result of this mode of life.

Stylactis minoi presents a third example of a hydroid, which has scarcely been modified at all by its association with a fish. Being attached to the skin of a sluggish rock-haunting species, it is capable of obtaining food in the same manner as most other hydroids. Consequently its structure has not been modified.

Definition of the genus—

The hydrophyton is a compact plate-like structure composed of an irregular labyrinthine cœnosarc with very poorly developed perisarc.

The hydranths are claviform when contracted, and totally devoid of tentacles ; their cavities are lined by a special layer of pavement epithelium, and they contain well-developed muscle-fibres among the endoderm.

The gonophores are closed sporosacs, without radial canals, tentacles, or ectodermal invaginations.

The species is parasitic on the skin of a surface-swimming fish.

REFERENCES.

1. Johnstone, J. .. "Report on the Marine Fishes," *Herdman's Ceylon Pearl Oyster Fisheries and Mar. Biol.*, pt. ii, 1904, p. 203.
2. Bronn, H. G. .. *Klassen und Ordnung. des Thier-Reichs*, bd. ii, abt. 2, 1889-92, p. 217.
3. Fewkes, J. W. .. "On certain Medusæ from New England," *Bull. Mus. Comp. Zool.*, vol. xiii, 1887, p. 224.
4. Collcutt, M. C. .. "On the structure of *Hydractinea echinata*," *Quart. Journ. Micros. Sci.*, vol. xl, 1898, p. 88.
5. Alcock, A. .. "A case of commensalism between a Gymnoblastic Anthomedusoid (*Stylactis minoi*) and a Scorpænoid Fish (*Minous inermis*)," *Ann. Mag. Nat. Hist.*, ser. 6, vol. x, 1892, p. 207.
6. Allman, G. J. .. *Monograph of the Gymnoblastic Hydroids*, 1871, p. 128.

EXPLANATION OF PLATE XVI.

FIG. 1.—The fish, *Monocanthus tomentosus*, with the parasite attached: drawn from the spirit specimen, natural size.

FIG. 2.—Diagram of the supposed appearance of the same, when the parasite is fully expanded: viewed from above and enlarged.

FIG. 3.—A portion of the colony showing eleven hydranths and gonophores attached to the disc: drawn from mounted specimen under $\frac{2}{3}$-inch objective with the camera lucida. Internal structure of the disc represented diagrammatically.
ST = "Straight tube."

FIG. 4.—View in optical section of a portion of the same, more highly magnified, showing the lower part of a single hydranth and a gonophore.
L = The lower limit of the specialized endoderm of the hydranth; this line is very clear in the specimen. for the cells above it (endoderm) are somewhat opaque and dark.
CT = The "connecting tube" which communicates on the one hand with the cavity of the hydranth and on the other with the "straight tube."
The connecting tube lies within what appears to be a closed spherical chamber, the thin walls of which are reflected on to the tube itself. This chamber was seen in the case of all hydranths available for examination both in optical and actual section, but the quality of the material was not sufficiently good to enable one to elucidate this structure with certainty.
ST = The "straight tube" which is embedded in the disc. One end of it communicates with the "connecting tube," the other opens into one of the cavernous spaces of the disc.
The curved dotted lines at the upper and left-hand part of the figure are to indicate an appearance due to "muscle fibrils" lying among the specialized endoderm cells.

FIG. 5.—Optical section of a female gonophore showing two ova. On the left side of each ovum the cell-outlines were indicated, but the "hexagonal pattern" mentioned in the text has been lost in the reproduction of the figure.

FIGS. 6, 7 AND 8.—Three of a series of sections through a male gonophore. Cell=outlines and spermatoblasts have been omitted in figs. 6 and 7, in order to show the arrangement of the endodermal layers with greater clearness. In fig. 8 the spermatoblasts and cell-outlines of the layers are indicated, but the detail is somewhat diagrammatic. The spermatoblasts are in places merged into the cells of the endodermal layers, but the continuity of the latter can be traced with assurance: drawn with camera lucida under $\frac{1}{6}$-inch objective.

PLATE XVI.

Fig. 1.

Fig. 3.

Fig. 2.

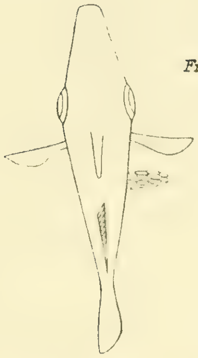


Fig. 4.

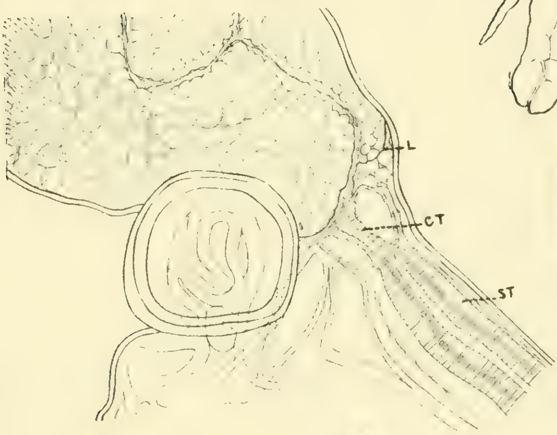
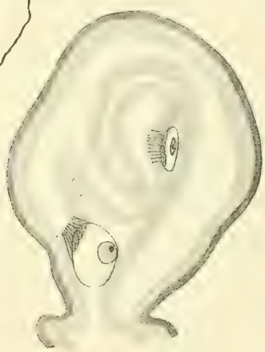


Fig. 5.



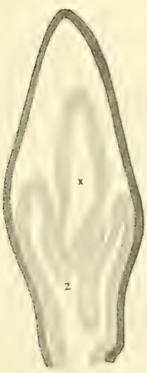


Fig. 6.

Fig. 7.

Fig. 8.

EXPLANATION OF PLATE XVII.

FIG. 1.—Transverse section of the lower part of a hydranth.
CC = Central cavity. M = Muscle strands.
The " mesenteries " which unite the lining of the central cavity to the ectoderm lie in a shrinkage space.

FIG. 2.—A somewhat oblique section at a higher level through another hydranth. Four " mesenteries " are seen; those on the left are cut obliquely.

FIG. 3.—A longitudinal section of a hydranth through the oral aperture.
The outlines for figs. 1, 2 and 3 were drawn under $\frac{1}{6}$-inch objective with the camera lucida. The muscle fibres are represented conventionally by dots and black lines. The real appearance is of a delicate fibrillation more accurately portrayed in fig. 4.

FIG. 4.—A small portion of a section from the same series as the one shown in fig. 2 under $\frac{1}{12}$-inch objective.
Ec = Ectoderm. CC = Central cavity. M = Muscle fibrils.
This figure shows that each " mesentery " is composed of two layers of delicate, nucleated cells which separate to form the central cavity. These features are best seen in the mesentery on the right; the one on the left being cut somewhat obliquely. The characters of the " specialized endoderm cells " are shown; the well-marked outlines, the peripheral granules, and the absence of nuclei.

FIG. 5.—A small portion of the disc in section under $\frac{1}{12}$-inch objective.
On the right a " straight tube " is seen opening into the common spaces of the disc.
The ectoderm is seen dipping down among the other layers: this is not usual.

Fig. 1.

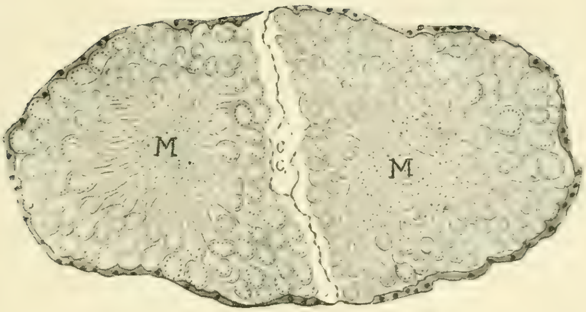


Fig. 2.

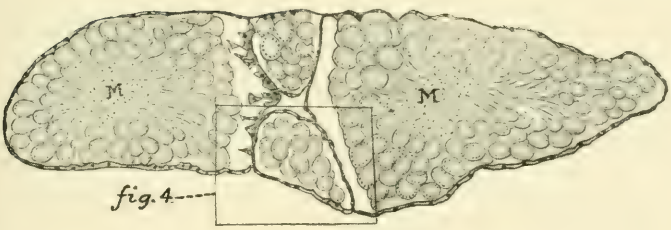


Fig. 3.

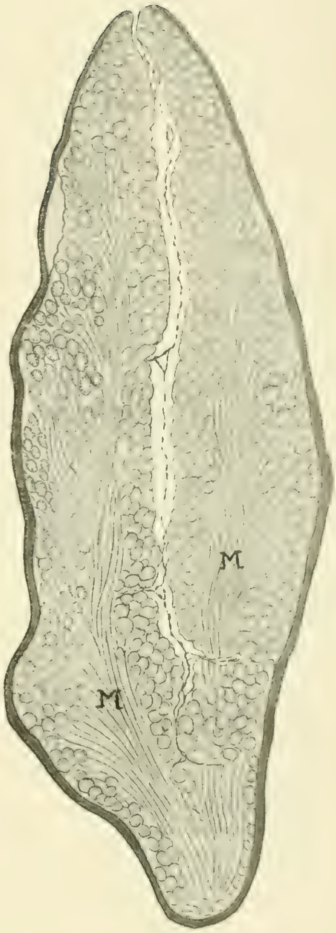


Fig. 4.

Fig 5.

XXIV.—PRELIMINARY DESCRIPTIONS OF THREE NEW *NYCTERIBIIDÆ* FROM INDIA.

By P. Speiser, *M.D.*

From the collection of the Indian Museum I recently examined three *Nycteribiidæ* which I considered to be new. But one of these species has already been mentioned in literature. Rondani gives in the *Ann. Mus. Genova* (1878), vol. xii, a short description of a parasite of the bat *Rhinolophus euryotis*, Temm., from Amboina, which he considered to be *Nycteribia jenynsii*, Westw. In my dissertation "Über die Nycteribiiden, Fledermausparasiten aus der gruppe der pupiparen Dipteren" (*Arch. Naturges.*, vol. lxvii, p. 11, 1901), I have demonstrated that *N. jenynsii*, Westw., is a *Penicillidia*, Kol. I had examined Rondani's very badly-preserved specimen, and provisionally determined it as *N. minuta*, Wulp. This latter name, as I have since learned, is a mere synonym of *Cyclopodia ferrarii*, Rond., and I am now very pleased at having before me a good specimen of the parasite of *Rhinolophus euryotis*, Temm., also from Amboina.

I give here a short description of it under the name *Nycteribia* (*Acrocholidia*) *phthisica*, sp nov., together with short descriptions of the two other new species. The detailed descriptions of these will be published in a larger monograph on this family, which I have in preparation. It would be of the greatest interest to examine more species from India of this extraordinary family, especially with good notes on the species of bats which harbour them. There are but very few known from East India, and there is a wide gap between the better known regions of the Sunda Archipelago and the African coasts, with Madagascar. We must expect some very interesting discoveries from the intermediate regions.

Nycteribia (*Acrocholidia*) *phthisica*, sp. nov., ♀.

Head and thorax without characteristics, the breast being almost twice as long as broad, being thus long and narrow (phthisic!). The lateral quarters of the basal tergite are bare, the middle bristly. In the middle of the dorsum is an irregular horizontal row of longer bristles; above the anal segment, a more chitinized rectangular shield, which bears three very long bristles on each of its rounded hind corners. The basal sternite has a linear hind margin, with a ctenidium of fine spines. Before the anal segment lie two band-like segments with wavy hind margins, the former of which has two pairs of bristles on each side of the middle line, and three on each side at the end; the posterior has but two separate bristles on each side of the middle, and but two on each side at the end. The plate above the genital opening bears a group of three bristles on the side lobes, and a single one a short distance before these. Long. corp. 2·3—2·4 mm.

Basilia bathybothyra, sp. nov., ♂.

Calcutta, 6th April 1905.[1] Head without characteristics. The thorax has conspicuous deep grooves above the halteres; the breastplate is somewhat broader than long. The second tergite has a broad middle lobe slightly produced backwards. All the tergites bear on the hind margins, scattered rows of thin, moderately long bristles; on the fourth, fifth and sixth tergite groups of bristles of double length occur which beset the margin a short distance each side from the middle. The basal sternite is large and long, its ctenidium having short, thin teeth; the succeeding sternites are very short, except the fourth and fifth which are slightly longer. The hind margins of these are slightly wavy in the middle, and bear there a little group of very short, black spines, or spine-like knobs. The following ones are thin, slightly curved, beset with bristles.

Cyclopodia amiculata, sp. nov., ♀.

Calcutta, on *Taphozous longimanus*. This is the most slender *Cyclopodia* I have seen, its length being 2·1 mm.; the single legs 3 mm.: the latter are thin, especially the femora, by which this species differs from the two other *Cyclopodiæ*. The abdomen is very singularly shaped. Besides a basal tergite, it shows but two broad and long tergites, and an anal segment. The posterior tergite bears on its anterior half a pair of very pistilliform styles, with bristly tips, as in the ♀ of *Nyct.* (*Stylidia*) *biarticulata*, Herm. The hind margin has, in the middle, a deep triangular notch, on the inner margins of which are a few bristles. The basal sternite bears a very dense linear ctenidium of fine spines; the ends of all the following segments are well marked by rows of bristles, the remaining surface (except in the second sternite) being bare

[1] [On *Vespertilio muricola*.—ED.]

XXV.—ANNOTATED CATALOGUE OF ORIENTAL *CULICIDÆ*.

By E. BRUNETTI.

INTRODUCTION.

In presenting this Catalogue I desire to mention that its preparation has been entirely a matter of compilation, and that I do not hold myself responsible for the validity of either the genera or species contained herein As a matter of fact, not having studied the *Culicidæ* except to a most limited extent, I should not feel competent either to support or contest the views of such experienced students of the group as those upon whose labours the present work is, in the main, compiled. A casual examination, however, of the slender characters upon which many of the recent genera and species are established, coupled with the fact that a large number of the latter have been described from single specimens only, leads me to the presumption that a few more years' careful study of the family is more likely to result in the reduction than otherwise of the total number of what to-day are regarded as distinct species. This is, of course, quite apart from new species to be hereafter discovered.[1]

The object of the Catalogue is to provide a systematic list of the mosquitoes recorded from the Oriental Region, and therefore, the comments are confined to questions of synonymy, or notes of general interest, and do not touch upon either of those vast sides of the subject, the biological and the medical. Brief information regarding the life-history, if known, and bare statements regarding the power, or otherwise, of any particular species to convey malaria, will be found ; but detailed reports of experiments or researches of an entirely medical or bacteriological nature, would be out of place in a purely systematic list. Mr. Theobald's excellent monograph of this family provides a lengthy list of works and essays, on the medical aspect, and nearly all the recent works of any size afford extensive information respecting life-histories, generally with copious illustrations.

---

[1] The collection of the Indian Museum in this group has not yet been worked out, except as regards *Anopheles*, and a few species amongst the other genera. It is of considerable extent, and is being rapidly enlarged by continual acquisitions, and at present is being worked out by Mr. Theobald.

I may add here that during my three years' sojourn in the East I have myself collected upwards of 1,500 specimens of *Culicidæ*.

A general study of this family may be obtained from Robineau Desvoidy's "*Essai sur les Culicides*" (1827), and, more recently Ficalbi's "*Revis. sistem. di famiglia d. Culicidæ*" (1896). Concerning exclusively oriental species, the following list may be found useful, in which is included a limited number of general works on the family, which, by reason of their importance, the student would do well to consult, even if interested only in oriental species.

LITERATURE ON ORIENTAL CULICIDÆ.

Adie, Major, 1905. "Mosquitoes and Malaria in the Ferozepore District." Ind. Medic. Gaz. xl, 5.

Banks, Ch. S., 1906. "A List of Philippine *Culicidæ*, with descriptions of new species." Phil. Jour. Sci. i, pt. 2, pp. 977 to 1005.

Id., 1906. "A new genus and species of *Culicidæ*." Loc. cit. i, pt. 2, p. 780, with plate.

Blanchard, R., 1905. "Les Moustiques."

Christy, C., 1900. "Mosquitoes and Malaria, Summary of Knowledge on the subject."

Ficalbi. (This author's papers are not on Oriental species, but will be found useful.) Bull. So. Ent. It. chiefly in vols. xxi, xxii.

Id. "Revisione sistematica di famiglia della *Culicidæ* Europee."

Giles, 1900. "Handbook of Gnats and Mosquitoes.' 1st Ed.

Id., 1902. 2nd Ed. of same work, much enlarged.

Id., 1901. "Six new species of *Culicidæ* from India." Entom., xxxiv, 192.

Id., 1901. "Descrip. of 4 new spp. of *Anopheles* from India." Ent. Month. Mag., xxxvii, 196.

Id. 1904.[1] Jour. Trop. Med., vii.

James, Capt. S. P., 1889. "The collection of Mosquitoes and their Larvæ." Ind. Medic. Gaz., xxxiv, No. 12.

Id. id., 1902. "Malaria in India." Sci. Mem. Offic. Medic. and Sanit. Dep. Gov. India, No. 2.

James and Liston, 1904. "The *Anopheles* Mosquitoes of India."

Liston, 1901.[1] Ent. Month. Mag., xxxvii.

Id., 1901.[1] Ind. Medic. Gaz.

Ludlow, Miss C. S., 1904. "Concerning some Philippine Mosquitoes." Can. Ent., xxxvi, 69.

Id. id., 1904. "Mosquito Notes" No. 1, loc. cit., 233; No. 2, l.c., 297.

Id. id., 1905. Id. id., No. 3, l.c., xxxvii, 94, 129; No. 4, l.c., 385.

[1] I have been unable to obtain the names of the papers thus referred to.

Neveu Lemaire, 1902. "Classification de la famille de *Culicidæ*."

Patton, W. S., 1905. "The Culicid fauna of the Aden Hinterland." Jour. Bomb. Nat. His. So. xvi, 623 to 637 with 4 plates and map.

Robineau Desvoidy, 1827. "Essai sur la tribu des *Culicidæ*." Mem. So. l'Hist. Nat. Paris, iii.

Theobald, F. V., 1900. "Report on the collections of Mosquitoes received at the British Museum."

Id., 1901. "Monograph of the *Culicidæ* of the World," vols. i, ii.

Id., 1903. Id., vol. iii.

Id., 1902. "A short descr. of the *Culicidæ* of India; with descr. of new spp. of *Anopheles*." Proc. Roy. So. Lond., lxix, 367 to 394 with 1 plate.

Id., 1902.[1] Jour. Trop. Medicine, v.

Id., 1903. "New *Culicidæ* from the Federated Malay States." Entom. xxxvi, 256.

Id., 1904. Id. (continuation). Entom., xxxvii, pp. 12, 36, 77, 111, 163, 211, 236.

Id., 1905. "Some new Mosquitoes from Ceylon." Jour. Bomb. Nat. His. So., xvi, 237 to 249 with 2 plates.

Id., 1905 "A catalogue of the *Culicidæ* in the Hungarian National Museum; with desc. of new gen. and spp." Ann. Mus. Hung. iii, 61 to 120, with 4 plates.

Id., 1905. Genera Insectorum; Fascicule 26. *Culicidæ*.

Mr. Theobald's "Monograph of the *Culicidæ* of the World" (in 3 vols.), from its magnitude holds prior place in the literature of this family. Volumes i and ii appeared in 1901, and contained, besides about 400 pages each of text, liberally augmented by figures, 37 plates (i to xxxvii) (bound up in a separate volume), each plate giving coloured figures of the full insects of four species. Five additional plates marked A to E gave photographic reproductions of wing-scales. At the beginning of vol. i is shown how to mount and examine a mosquito. The first 60 pages give endless information regarding structure, life-history, food, habits, pairing, hybernation, natural enemies, geographical distribution, etc. From p. 84 the malarial aspect of the subject is treated of. On p. 97 is a synoptic table of sub-families and genera followed by a list of the world's species (up to 1901); those present in the British

[1] I have been unable to obtain the names of the papers thus referred to.

Museum collection being marked. Further lists of species follow, arranged according to their geographical distribution. Volume iii (1903) gives 17 more plates of photos of wings and wing-scales ; the last two, however, being of larvæ and pupæ.

In Fascicule No. 26 of the "Genera Insectorum" (1905), Mr. Theobald gives a table of sub-families, admitting eight, as follows : *Anophelinæ, Megarhinæ, Toxorhynchitinæ, Culicinæ, Joblotinæ, Ædeomyinæ, Heptaphlebomyinæ* and *Corethrinæ*. Sixty-seven genera (described) are recognised, containing slightly over 500 species, being the total number known including a few new ones. He also gives 2 coloured plates showing 24 full insects.

Lieutenant-Colonel Giles's work, "Handbook of Gnats, or Mosquitoes" is a valuable one. First published in 1900, it attained a second edition in 1902. Chapter i (2nd Ed.), concerns the position and terminology of the *Culicidæ* ; chap. ii, collecting and preserving ; chaps. iii to vi, the anatomy of the larva, pupa and adult, with many figures ; chap. vii, life-history. Plate vi gives photos of living *Anopheles* and *Culex* resting on glass. Conditions influencing prevalence is treated of on p. 152, and a valuable diagram is fig. 38 (facing p. 256), giving a key to generic distinctions based on the characters of the scales.

Although confined to *Anopheles* (sensu latu), Messrs. James and Liston's "*Anopheles* Mosquitoes of India" is also of great value, if only for the splendid plates. The earlier part deals with general notes, eggs, larvæ (figured), habitats, collecting, mounting, preserving, larva-mounting, classified table of *Anopheles* larvæ ; distribution and classification of Indian species, and a very excellent diagrammatic plate showing the structure of the various parts of the adult, with their technical terms. The work terminates with 14 other splendid plates (tinted) of large size, illustrative of that number of Indian species.

Mr. Banks' catalogue of the Philippine *Culicidæ* is most useful. Many of the Oriental species, if correctly determined, have an excessively wide range. From Africa (South and West Coast), Mauritius, and Australia, from China, and from Europe, certain species are regarded as identical with forms indigenous to the Orient. It will be noticed that I have included the few Arabian species mentioned in Mr. Patton's paper on the Aden hinterland Culicid fauna ; this is because, owing to their wide range of distribution, any of those species may easily occur in India, and not from a desire to include Arabia in the Oriental Region.

To avoid repetition in the catalogue, I append here a brief list of such localities as constantly occur, with particulars added.

Bakloh	..	4,500 to 5,000 ft. Punjab, Lower Himalayas.
Bhim Tal	..	4,500 ft. Kumaon Dist., Western Himalayas.
Canara District	..	On Goa Frontier, W. Coast of India, S. of Bombay.
Cavite	..	Close to Manila (Luzon, Phil. Islands).
Coonoor	..	6,000 ft. Nilgiri Hills, Madras Presidency.

Dacca	..	Eastern Bengal.
Dindings	..	Straits Settlements.
Ellichpur	..	Berar, Central India.
Ferozepore	..	Punjab.
Fort McKinley	..	Luzon, Phil. Islands.
Goa	..	District on West Coast of India.
Gonda	..	N. India, S. of Nepal.
Jalpaiguri	..	N. Bengal, a little south of Darjiling.
Jeypore	..	State in Madras Presidency.
Jhansi	..	North-West Provinces, India.
Jolo Island	..	Philippines.
Karachi	..	City on extreme West Coast of India, near Baluchistan.
Karwar	..	Coast Town, Bombay Presidency.
Kuala Lumpur	..	Capital of Selangor State (Federated Malay States).
Kurseong	..	5,000 ft. South of Darjiling.
Lushai Hills	..	On the N.-E. Indian Frontier of Assam.
Makerian	..	Hoshiarpur District, Punjab.
Mian Mir	..	Punjab, about 6 miles from Lahore.
Mussoorie	..	6,000—7,000 ft. Punjab Himalayas, near Simla.
Nagpur	..	District in Central Provinces, India.
Naini Tal	..	6,400 ft. Kumaon Dist., W. Himalayas.
Negros (Negros Occidental)	..	Island in the Philippines.
Nilgiri Hills	..	Madras Presidency.
Old Calabar	..	West Coast of North Africa.
Orissa	..	East Coast India.
Pampanga	..	One of the Philippine Islands.
Pangasinan	..	One of the Philippine Islands.
Peradeniya	..	Ceylon.
Perak	..	Federated Malay States.
Port Canning	..	30 miles from Calcutta, on Matla River.
Purneah	..	North Bengal.
Quilon	..	Coast town in Travancore State, extreme S. of India.
Ranikhet (Reneghat)		4,000 ft. North-West Provinces, India.
Rizal	..	Near Manila.
Selangor	..	Federated Malay States.
Shahjahanpur	..	North-West Provinces, India.
Shaohyling	..	China.
Simla	..	7,000 ft. Western Himalayas.
Sylhet	..	District in Assam ; adjoining Darjiling.
Taiping	..	Capital of Perak · Federated Malay States.
Trincomalee	..	(Hot Wells) East Coast of Ceylon.

N.B.—In Messrs. James and Liston's "*Anopheles* Mosquitoes of India," their references to Jeypore I infer to relate to that city and State in the Madras Presidency, from their spelling of the name.

There is, however, another town and state of the same name, in the Rajputana District of N.-W. India, but this latter place is usually spelt Jaipur.

N.B.—In Mr. Theobald's Monograph, the following data appear, attached to a number of species: "Perak (Wray), 22nd November 1899 and 21st December 1899." As it is not obvious whether the dates refer to two separate days only, or are intended to include the intervening period between them, I have omitted them from my catalogue.

It will be seen that I have admitted four sub-families only,—*Anophelinæ*, *Culicinæ*, *Ædeomyinæ*, and *Corethrinæ*,—and I am strongly inclined to the opinion that the first two would be in every way sufficient. It has not been considered necessary to include every reference known, and cases where simply the name of a species is mentioned, have always been avoided. It has, however, been my object to include all possible diagrams or plates, and to give all the dates and localities available.

I desire to express my obligations to Dr. Annandale of the Indian Museum for his permission to use the Museum Library, without which the compilation of this catalogue would have been impossible.

CATALOGUE.

Sub. Fam. ANOPHELINÆ.

ANOPHELES Meig., 1818. (sensu strictu)

Sys. Besch., i, 10; pl. x, 5, 6.

Macq.	1834,	Hist. Nat. Dip., i, 32.
Wlk.	1848,	List Dip. Brit. Mus., i, 9.
Sch.	1864,	F. Austr., ii, 624.
Wulp	1877,	Dip. Neer., 329.
Skuse	1889,	Pr. Linn. So., N.S. Wales, p. 1751
Ficalbi	1896,	Bull. So. Ent. It., 221.
Theob.	1901,	Mon. Culic., i, 115 (sensu latu).
Id.	1903,	Loc. cit., iii, 11 (sensu stricto).
Giles	1902,	Handbk., 2nd Ed., 283 (as restricted by Theobald); table of spp. p. 289.
Theob.	1902,	Proc. Roy. So. Lond., lxix, 368; table of Indian spp.
Theob.	1905,	Gen. Ins. Fasc. 26, p. 6.

Giles in "Handbook," 2nd Ed., 283, gives as a reference of "*Anopheles* as restricted by Theobald," Theob. Mon. Culic., i, 115; but this is incorrect. That reference is of the genus in its wide (Meigen's) sense; as Theobald had not created his other genera till 1902. All the *Anopheles* in the first volume of the Monograph are placed under "*Anopheles*" genus. Theobald's first reference in that work to the restricted genus is in vol. iii, p. 11. Most of the new genera were published in the "Jour. Trop. Med." (1902), vol. v.

A vast amount of information on the life-histories and habits of the species of this genus may be obtained from the recent works. Mr. Theobald, in Monog. Culic., i, 115, gives general information; a list of districts from which various species of *Anopheles* have been received and recorded by the British Museum. On p. 118 is a map of the geographical distribution of the genus, on p. 120 a synoptic table of the world's species up to 1901. In vol. iii, p. 107, is a list of species arranged according to the countries they inhabit; on p. 1 a chart, comparing the relative frequency of *Anophelina* and *Culicina*. Plate v gives wing-scales of *Anophelina*; p. 14 the differences between the ova and larvæ of the two groups *Anophelina* and *Culicina*.

1. **A. aitkenii** James in Theob., 1903.

Theob. Mono. Culic. iii, 22 ♀.

James and Liston, Anoph. Mosq. Ind. 119, pl. ix, 3, wing-scales; pl. xiii, larva figs. and wing.

LOCALITIES: Goa Frontier [*Aitken*] Karwar [*Aitken, Dr. Cogill*].

2. **A. arabiensis** Patton, 1905.

Jour. Bomb. So., xvi, 623 ♂ ♀; pl. A, wing, palpus, egg.

"The commonest species in the district" (Aden hinterland) [Patton].

The larva breeds in pools, streams and wells, apparently breeding at different times of the year in different localities.

The adult is certainly a malaria-transmitter, and, as far as the writer (Patton) knows, is the only certain one under natural conditions in this district.

LOCALITY: Aden hinterland [*Patton*].

3. **A. dthali** Patton, 1905.

Jour. Bomb. So., xvi, 627 ♂ ♀; pl. A, wing, palpus, egg.

A free biter, and probably a malaria-carrier; found breeding all round the native camps (alt. 5,000 feet).

LOCALITY: Aden hinterland [*Patton*].

4. **A. gigas** Giles, 1901.

Ent. Month. Mag., xxxvii, 196 ♂ ♀.

Theob. Mon. Culic., ii, 308 ♂ ♀.
James and Liston, Anoph. Mosq. Ind. 118 (Theob.'s desc. copied).
Giles Hdbk., 2nd Ed., 316 ♂ ♀; pl. x, 2, wing ♂ ♀.

Types in British Museum.

The larva appears to prefer clear, shallow water, and the species is said to be not rare in the hills, although I can only find one definite reference.

LOCALITY: Coonoor (5,000 to 6,000 feet) in the Nilgiri Hills [*Price*].

5. **A. immaculatus** Theob., 1903.

Mon. Culic., iii, 23 ♀.

James (1902) Sci. Mem. Ind. No. 2, 35.
James and Liston, Anoph. Mosq. Ind., 120.

This species was *named* by James in the "Sci. Mem. Ind." (1902), but *not described* there, as the words "wings entirely unspotted, legs unbanded" cannot be considered a description. Theobald first *described* it in his "Monog., iii, 23" from a single perfect ♀, adding as a locality "India, evidently from Goa." However, in James and Liston's "Anoph. Mosq. Ind.," they say (p. 120) "Mr. Theobald says the specimen is evidently from Goa, and that it was given him by Capt. Liston. This is incorrect. It was captured at Ennur, a small village on the East Coast, about ten miles from Madras, and sent to Mr. Theobald by Dr. Stephens." The ♂ is unknown; it is distinct from all other *Anopheles* by the unspotted, yellowish wings, and will probably require the erection of a new genus.

LOCALITIES: Ennur (East Coast, near Madras) [*James and Liston*].

6. **A. lindesayii** Giles, 1900.

Hdbk. Gnats, 1st Ed., 166 ♀.

Giles l.c., 2nd Ed., 323 ♀; pl. x, 8, wing ♀.
Theob. Mon. Culic, i., 203; pl. v, 19 ♀. Full ins. col.
James and Liston, Anoph. Mosq. Ind., 117. Col. pl. xv, full ins. ♀.

I find no references to this species from other than hill localities. Dr. Christophers has studied the larva. Capt. James found it breeding in natural pools along with *Nyssorhynchus maculatus* Theob., at Raneghat, and Dr. Annandale found it breeding in water butts close to the houses of Europeans at Bhim Tal in September.

LOCALITIES: Bakloh (Punjab, July, 4,585 feet) [*Lindesay*]; Naini Tal (6,500 to 7,000 feet) [*Giles*]; Kurseong, Mussoorie, Raneghat (4,000 ft.) [*James*]; Bhim Tal (4,500 feet, Sept. 1906) [*Annandale*].

7. **A. wellcomei** Theob., 1904.

Theob. Rep. Gordon Coll. Labor. Sudan, p. 64.

LOCALITIES: Aden hinterland and Sudan.

MYZOMYIA Blanchard, 1902.

Comp. rend. Soc. Biol. Paris, xxiii, 795.

nom. nov. for *Grassia* Theob. preoc. Fisch., 1885.

There is also a *Grasia* Mich., 1854, in Echinodermata.
Grassia Theob., 1902, Jour. Trop. Med., ii, 181.
Myzomyia Theob. Mon. Culic., iii, 24.
Id. *id.* Gen. Ins. Fasc. 26, p. 7.

The larvæ in this genus are mostly found in flowing water, more rarely in ponds or stagnant water, except *rossii* and a non-oriental species, *superpictus* Grassi.

1. M. aconita Donitz, 1902.

Beit. Kennt. 3, d. Anoph., p. 70, ♀.

Theob. Mon. Culic., iii, 30, fig. (p. 31), wing ♀.

Theobald's description is a translation of Donitz's, whose description was apparently drawn up from a unique ♀ in spirits.

LOCALITIES: Kajoe Tanam, Willen Is., Soekaboemi (Java) [*Donitz*].

2. M. albirostris Theob., 1903.

Mon. Culic., iii, 24 ♂ ♀. Fig. 11, p. 25, palpi and proboscis. Described from a perfect ♂ and ♀.

LOCALITY: Malay States (May) [*Durham*].

3. M. azriki Patton, 1905.

Jour. Bomb. So., xvi, 630 ♂ ♀. Pl. C, wing, palpus.

Patton says it is a wild species breeding in pools with *tibani* Patton, and that it is closely related to "*turklandi* Liston," but I know of no such species as the latter. Perhaps he means *turkhudi* Liston.

LOCALITY: Azriki, (Aden hinterland, 5,000 ft.) [*Patton*].

4. M. culicifacies Giles, 1901.

Ent. Month. Mag., xxxvii, 197 ♀ (*Anopheles* id.).

N.B.—The ♂ in above reference = *turkhudi* Liston ♂.

Anoph. culicifacies ♀ non ♂. Theob. Mon. Culic., ii, 309 (t. Th. l.c., iii, 48).
Id. *id.* James & Liston, Anoph. Mosq. Ind. 106, pl. ix, 2, wing scales; pl. viii, 1, larva figs.; col. pl. xi, full ins. ♀.
Id. *id.* ♀ non ♂. Giles, Handbk., 2nd Ed., 317; pl. ix, 12 ♂ ♀.

Myzomyia culicifacies ♀ Theob. Pr. Roy. So. Lond., lxix, 379.
Id. *id.* ♀ Theob. Mon. Culic., iii, 39, fig. (p. 40) frontal larva hairs; pl. iii, wing, pl. viii, wing scales.

Anoph. listoni Giles, 1901, Ent. Month. Mag., xxxvii, 197 ♂ ♀.
Id. *id.* Giles, Handbk., 2nd Ed., 319 ♂ ♀; pl. x, 4, wing ♂ ♀, head ♂ ♀.
Id. *id.* ♀ Theob. Mon. Culic., ii, 311 (App.).
Id. *indica* Theob., 1901, Mon. Culic., i, 183 ♀.
Id. *indicus* Giles, Handbk., 2nd Ed., 320 ♀.

Type in British Museum.

A common and well distributed species throughout India, the larva breeding freely in canals, streams, ditches and irrigation watercourses in the Punjab throughout the year, although the adults only occur there (in houses) from March to December. In the Deccan it is commonly found throughout the year in river beds, and in S. India it is common in rice fields and pools.

Experiments show that the three kinds of malaria parasites readily develop in it, and Dr. James states that it has been proved to carry malaria in Mian Mir and Ennur.

This species assumes the characteristic position of *Culex* when at rest, and is related to *listoni*, and *jeyporensis* James.

Localities: Madras (Dec.) [*Cornwall*]; Ferozepore, nearly all the year except Jan. and Feb. [*Adie*]; Rajmahal (N. Bengal) 31-vii-1907 [Ind. Museum]; Armageon (E. Coast, India) [*James*]; Ellichpur (Berar, India) [*Liston*]; Etawah, (N.-W. Prov.); Hoshangabad (Cent. Prov.); Mian Mir: Nagpur, Jeypur State.

5. **M. elegans** James in Theob., 1903.

Mon. Culic., iii, 51, ♀ fig. 28, wing scales, cross veins; fig. 29, wing.

Anoph. elegans James and Liston. Anoph. Mosq. Ind. 82 ♀. pl. ix, 4, wing scales: pl. xii, wing, palpus, leg, larva.

This species is considered as only a variety of *leucophyrus* Donitz, by James and Liston, but Theobald considers it distinct. It has been bred by Dr. Cogill from larva from pools and jungle springs in Karwar. The adults are said not to frequent houses. The ♂ is unknown, and the type is in the British Museum.

Locality: Karwar (April) [*Cogill*].

6. **M. funesta** Giles, 1900.

Jour. Trop. Med., ii, 50 (*Anopheles* id.).

Anopheles *id.* Giles Handbk., 2nd Ed., 318, ♂ ♀; pl. x, 3, wing ♂ ♀, claws ♂, head ♀.

Anopheles funestus Theob. Mon. Culic., i, 178 ♂ ♀ ; fig. (p. 53) cross veins ; fig. (p. 180), genitalia ♂ , fore ungues ♂ , cross veins ; pl. iv, 13 ♀ , full ins. col.
Myzomyia *id.* Theob. l.c., iii, 34, pl. ii, wing ♀ .
Id. *id.* Theob. Gen. Ins. Fasc. 26, pl. i, 2 ♀ , full ins. col.

Two varieties from West Africa (Gambia), the home of the species, are known, both taken by Dr. Dutton.

var. *umbrosa* Theob. Mon. Culic., iii, 34 ; pl. ii, wing ♀ .

var. *subumbrosa* Theob. Mon. Culic., iii, 34 ; pl. ii, wing ♀ .

This latter variety has considerable resemblance to *listoni* Liston.

? *kumasii* Chalmers. Lancet, 1900 (Novem.) ♂ ♀ (*Anopheles* id.).

This latter description is repeated in Theob. Mon. Culic., i, 214 ♂ ♀ , where the author adds, "I believe to be a new species. It might, however, be a var. of *A. funestus.*"

Practically an African species.

Taken in dwelling-houses at Kumasi ; Ashanti, where Dr. Chalmers found the larvæ on the margin of the marsh surrounding that place. Abundant on the Gambian Coast, and at the Cape (near Bathurst), the larva being found in rice swamps. It occurs in November in Lagos and in December in Gambia, and Giles reports it from British Central Africa at an altitude of 5,600 feet.

It figures in this Catalogue only on the authority of Banks, although it has been doubtfully recorded from the Philippines before.

LOCALITY : Pampanga (Phil. Is.) [*Banks*].

7. **M. jehafi** Patton, 1905.

Jour. Bomb. So., xvi, 630 ♂ ♀ ; pl. C, wing, egg, palpus ♂ ♀ .

The eggs were found in springs at Dthali, Arabia, and the species (which appears to be a local one) was bred, and found to bite freely.

LOCALITIES : Jehaf and Dthali 5,000 ft. (Aden hinterland) [*Patton*].

8. **M. leptomeres** Theob., 1903.

Mon. Culic., iii, 38 ♀ .

Described from a single ♀ .
Locality : India [*Christophers*].

9. **M. leucophyrus** Donitz, 1901.

Insectenborse, v, 37 ♀ (*Anopheles*).

Theob. Mon. Culic., ii, 307 (*App.*) ♀ .
James & Liston, Anoph. Mosq. Ind., 82.
Giles Handbk., 2nd Ed., 312 ; fig. 44, wing.

James and Liston regard *elegans* James. (*loc. cit.*) as a variety of this species. However, Theobald considers *elegans* a valid species.

LOCALITIES: Kajoe Janam (Sumatra); Moerah Teweh (Borneo) [*Donitz*].

10. M. listoni Liston, 1901.

Ind. Med. Gaz., xxxvi, 12 ♀ (*Anopheles* id.).

non listoni ♀ *Giles.*

Theob. Mon. Culic., iii, 27 ♀; fig. 12, palpus ♂ and scale of wing; fig. 13, wing; p. 40, fig. 17, hairs of larva.
Anoph. christophersi Theob., 1902, Pr. Roy. So. Lond., lxix, 378 ♀; pl. v, 3, wing ♀.
Id. *id.* James & Liston, Anoph. Mosq. Ind., 103; pl. vii, 1, larva figs; col. pl. x, full ins. ♀.
Id. *fluviatilis* Christophers, 1901, in MS.
Id. *id.* James, Sci. Mem. Ind. No. 2, p. 31, fig. 9.

"Described by me in Pr. Roy. So. Lond., lxix, 378 ♀ as *christophersi* from 2 ♀ ♀ sent to that Society by Drs. Christophers and Stephens, but just previously described as Giles's '*Listoni*' by Capt. Liston." (Theob. Mon. Culic., iii, 28.)

The species is very near *culicifacies* Giles, and *jeyporensis* James.

Aitken has studied the larva (*vide* Theob. Monog. iii, 29) which occurs in rice fields and small rocky streams, but abounds most in boggy ground near rice fields.

James and Liston report the larva from clear streamlets with grassy edges, and state definitely that the species is a malaria carrier as proved both by experiment and under natural conditions.

Messrs. Alcock and Adie, in the Proc. Roy. So. Lond., lxxvi, 319, give a short, interesting account of breeding this species from larvæ (collected 7-ii-1905) from the Indian Museum tank. They bred 7 adults from 26 larvæ, the remaining 12 larvæ (placed in a separate vessel) being voraciously devoured by the larva of a very common oriental dragon fly (*Ceriagrion coromandelianum*). The existence of *Listoni* in Calcutta is important, owing to the malaria-carrying powers of this insect. The Malaria Commission found the species absent during their investigations in June, July and August, and attributed the absence of malaria from Calcutta, to the absence during those months of known malaria carriers. Messrs. Alcock and Adie, taking it in December and January (no adults were found in February), will make it desirable for the species to be searched for diligently by other observers.

LOCALITIES: Ellichpur (Berar, India); Nagpur; Bengal Duars; Calcutta (Dec. and Jan.) [*Alcock, Adie*]; Jeypur; Goa; Bombay; Aurangabad (Hyderabad State) [*James*]; The Duars, India [*Christophers*]; Perak [*Wright*]; North Canara District (Goa) [*Aitken*]; Sylhet, 21-i-1905 and 2-ii-1905 [*Hall*].

11. **M. ludlowii** Theob., 1903.

Mon. Culic., iii, 42.

Fig. 19, *b*, palpus ♂ ; fig. 20, wing ♀ ; fig. 21, vars. in wing marks and cross veins ; figs. 22, costal spots.

By far the commonest of the malaria group in the Philippines, breeding readily in salt water around Manila.

LOCALITIES : Pampanga (Phil. Is.) [*Whitmore*] ; Manila [*Banks, Schultze, Wooley*] ; Luzon (April) [*Ludlow*] ; Singapore [*Biro*].

12. **M. mangyana** Banks, 1906.

Phil. Jour. Sci., i, 991 ♀ .

Described from several ♀ ♀ . Type No. 3290 in the Entomological collection, Bureau of Science, Manila. The species is near *ludlowi* Theob.

LOCALITIES : Rio Baco, Chicago (in Mindoro, Phil. Is., May) [*McGregor*].

13. **M. punctulata** Donitz, 1901.

Insectenborse, v, 37.

non Anoph. id. Theob., Mon. Culic., i, 175.
? Anoph. id. James & Liston Anoph. Mosq. Ind. 84 ; pl. xi, wing, palpus, leg.

As the above authors (*loc. cit.*) give " Theob. Monog., i, 175 " as a synonym of their species, and as Theobald's "*Anoph. punctulata* Don." is not that species, but a distinct one, *tessellatus* Theob., I am rather uncertain which species James and Liston had before them at the time of writing.

They add, " very closely resembling *leucophyrus*, and may be a seasonable variety of that species."

LOCALITIES : Kajoe Janam (Sumatra), Moerah Teweh (Borneo) [*Donitz*] ; Friedrich Wilhelmshafen, Stephansort, Astrolabe Bay and Deslac Is. (all Papua) [*Biro*].

Regarding James and Liston's species, these authors give Karwar (in house), Bombay (August, in house)," Straits, Sumatra and Borneo."

N.B.—Vide notes under *Myzomyia tessellata* Theob.

14. **M. rossii** Giles, 1899.

Jour. Trop. Med., ii, 63 ♂ ♀ (*Anopheles*).

Anopheles *id.* Theob. Mon. Culic., i, 154 ♂ ♀ .
Fig. 37, wing and cross veins; fig. 38, palpus ♂ , thorax ♀ , costal border ♂ ♀ , ungues ♂; pl. A, wing scales ; pl. iii, 10 ♂ , 9 ♀ , both full ins. col.
Id. *id.* Giles Handbk., 2nd Ed., 311, ♂ ♀ , pl. ix, 11, wing ♂ ♀ , claws.

Anopheles rossii James and Liston, Anoph. Mosq. Ind. 109; pl. vi, 1, larva figs.; pl. x, 3, wing scales; col. pl. xii, full ins. ♀.
Myzomyia id. Theob. Mon. Culic., iii, 45, fig. 23, wing ♀, figs. (pp. 46, 47) hairs of larva; pl. iii, wing; pl. vi, wing scales.
Anoph. vagus Donitz, 1902, Beit. z. Kennt. Anoph., p. 80.

The larva is easily noticed, often being found in great numbers together, and breeds anywhere in pots, puddles, pools, from running clear water to very foul water, and water containing 2·8 per cent of salt, but Chatterjee found that larvæ from water containing less than half this amount of salt died on being placed in fresh water. The species occurs up to an altitude of 5,000 feet. In Madras it breeds in rice fields nearly all the year round, and James and Liston say the adults are in the habit of frequenting "railway carriages and almost every kind of road conveyance." The former found it abundant in October at Mian Mir, breeding in muddy, shallow pools and tanks, but not in the irrigation canal. In Perak it has been bred during February from larvæ. It is variable and occurs apparently all over India, the Malay Peninsula, South China, the East India Islands and the Philippines. Captain James never found a specimen in a natural state infected with malaria, although he examined nearly 800 from various parts of India, but he proved, that experimentally, *Filaria sanguinis-hominis* would develop in the species (*vide* "Lancet" Aug. 11th, 1900, p. 451). Theobald (Pr. Roy. So. Lond. lxix, 377) also regards it as a non-malaria carrier. It has been recorded from the Philippines by its place in Banks' Catalogue, but he gives no data, nor have I seen any definite record from these Islands.

LOCALITIES: Sylhet (Jan., Feb., Apr., May, June) [*Hall*]; Rajmahal, Bengal (31-vii-1907) [Ind. Museum]; Lucknow (Apr.) [*Giles*]; Mian Mir (Oct., Nov., "very abundant") [*James*]; Mozufferpur (Behar) [*Green*]; Dacca [*Macrae*]; Etawah, N.-W. Prov., and Canara District [*Aitken*]; Mukerian (Hoshiarpur, India) [*Datta*]; Madras (Nov. to March) [*Cornwall*]; Quilon (7-iii-1900) [*James*]; Calcutta (April) [*Annandale, Daniels*]; Port Canning (17-iii-1907, 21-vii-1907) [*Annandale*, Dec., "common," *Chatterjee*]; Kuala Lumpur [*Durham*]; Ferozepore (late July to mid. Dec.) [*Adie*]; Perak [*Wray, Wright*]; Penang [*Freer*]; Padang (Sumatra) [*Donitz*]; Singapore (22-vii-1899) [*Hanitsch*]; Jalpaiguri (June 1907); Sambalpur (Cent. Prov.); Bombay.

Sub. species **indefinita** Ludlow, 1904.

Can. Ent., xxxvi, 299 ♀.

LOCALITIES: Bayambang in May (Pangasinan, Philippine Islands) [*Chamberlain*]; Mangarin (September), Guimaras Islands (December) (both Philippine Islands).

15. **M. tessellata** Theob., 1901.

Mon. Culic., i, 175 ♀ (as *Anoph. punctulatus* Donitz).

Loc. cit. fig. 49, thorax, wing, hind leg; pl. xxxvii, 148 ♀, full ins. col.

Anoph. tesselatus (lapsus) Giles, Handbk., 2nd Ed., 305 ♀; pl. ix, 7, wing ♀, dorsum of thorax, hind tarsus.

Respecting this species, Mr. Theobald had prepared for his monograph a new species which he had named *tessellatum*, but which, just previous to publication, he considered to be synonymous with *A. punctulata* of Donitz, recently published. He therefore used the description of his species as that of *A. punctulatus* Donitz in Mon. i, 175, and confirmed this opinion in vol. ii, 306 (Appendix), for the sake of those correspondents who already possessed the species under his MS. name. However, in vol. iii, 55, he says that Donitz had informed him that the two species were quite distinct. Therefore, Theobald's description in Mon. i, 175, for what he there called *A. punctulatus* Donitz, stands good as the original description and reference of his own *tessellata*, which now ranks as a good species.

LOCALITIES: Taiping (Straits) in May, 22-xi-1899 and 21-xii-1899 [*Wray*].

16. **M. thorntoni** Ludlow, 1904.

Can. Ent., xxxvi, 69 ♀.

Described from two ♀ ♀ only, and said to be near *M. albirostris*.

LOCALITIES: Cottabato (Mindanao, June, Philippine Islands) [*Thornton*]; Oras (Samar Islands, Philippine Islands).

17. **M. turkhudi** Liston, 1901.

Ind. Med. Gaz. xxxvi, 441 ♀ (*Anopheles turkhudi*).

Anoph. turkhudi Giles, Handbk., 2nd Ed., 320 ♀ (footnote).
Id. *id.* James Sci. Mem. Ind. No. 2, p. 49., fig. 27, wing; fig. 28, larval chars.
Id. *id.* James & Liston, Anoph. Mosq. Ind. 115; pl. viii, 2, larva figs.; col. pl. xiv, full ins. ♀.
Myzomyia id. Theob. Mon. Culic. iii, 48 ♀; pl. iii, wing.
Anoph. culicifacies Giles, Ent. Month. Mag., xxxvii, 197.
Id. *id.* ♂ Theob. Mon. Culic., ii, 309.
Id. *id.* Theob. Pr. Royal So. Lond., lxix, 379 ♂, fig. 2 (p. 380) genitalia ♂.
Id. *id.* ♂ Giles, Handbk., 2nd Ed., 317; pl. ix, 12, ♂ ♀.

Dr. Christophers has studied the larva and, under experimental conditions, human malarial parasites will develop in the adult.

LOCALITIES : Ellichpur (Berar, India), Nagpur and Cashmir [*James*]; Andaman Islands [*Maj. Anderson*]; Hoshangabad (Cent. Prov., India); Lahore; Ferozepore, rare [*Adie*].

STETHOMYIA Theob., 1902.

Jour. Trop. Med., v, 181.

Theob. Mon. Culic., iii, 62; pl. viii, wing scales of *S. nimba*, an African species.
Theob. Gen. Ins. Fasc. 26, p. 8.

1. S. culiciformis James and Liston, 1904.

Anoph. Mosq. Ind. 122 ♂, ? ♀ (*Anopheles*); pl. xv, larva figs.

Apparently both sexes are intended to be included in the description, although only the ♂ is specially mentioned. The authors say that Theobald would place it in this genus. Dr. Cogill bred the species at Karwar from larvæ.

LOCALITY : Karwar [*Cogill*].

2. S. fragilis Theob., 1903.

Entom., xxxvi, 257 ♂.

Described from two ♂ ♂ bred by Dr. Durham from larvæ found in a clear water jungle pool. Types in British Museum.

LOCALITY : Kuala Lumpur in Dec. and Jan. (Fed. Malay States) [*Durham*].

3. S. pallida Ludlow, 1905.

Can. Ent. xxxvii, 129 ♀.

Described from a single ♀, " taken in the woods."

LOCALITY : Pampanga (Luzon) [*Whitmore*].

PYRETOPHORUS Blanchard, 1902.

Comp. rend. So. Biol. Paris, xxiii, 795.

nov. nom. for *Howardia* Theob. preoc. by Dalla Torre in 1897.
Howardia Theob., 1902, Jour. Trop. Med., v, 181.
Pyretophorus Theob. 1903 Mon. Culic., iii, 66.
Id. Theob. Gen. Ins. Fasc. 26, p. 8.

1. P. freerae Banks, 1906.

Phil. Jour. Sci. i, 993 ♀.

Type specimen in the Entomological Collection (Type No. 5975) of the Bureau of Science, Manila.

LOCALITY : Manila (Oct.) [*Banks*].

2. **P. jeyporensis** James, 1902.

Sci. Mem. Ind. No. 2, p. 32 (*Anopheles id.*).
Fig. 11, wing; fig. 12, larval characters.
Pyretophorus id. Theob. Mon. Culic., iii, 66; pl. viii, wing scales, fig. (p. 67) palpus ♂.
Anopheles id. James & Liston Anoph. Mosq. Ind. 101; pl. vii, 2, larva figs.; col. pl. ix, full ins. ♀.

Near *listoni* and *culicifacies*; the larva living mostly in rice fields, but also in streams.

Localities: Jeypur State [*Christophers* and *Stephens*]; Jakot (S. India) [*Aitken*]; Nagpur and Bombay.

3. **P. minimus** Theob., 1901.

Mon. Culic., i, 186 ♀ (*Anopheles*), fig. 55, wing, thorax, cross-veins.
Anopheles. id. Giles Handbk., 2nd Ed., 321 ♀; pl. x, 7, wing ♀, thorax, scale.
Pyretophorus id. Giles, Jour. Trop. Med., vii, 365.
Described from a unique ♀ in Dr. Rees's collection.

Localities: Pokfulam, Hongkong [*Dr. Rees*]; Pampanga (Luzon) [*Whitmore*].

4. **P. philippinensis** Ludlow, 1905.

Can. Ent. xxxvii, 135.

Locality: Pampanga (Luzon) [*Whitmore*].

5. **P. pitchfordi** Giles, 1904.

Jour. Trop. Med., vii, 365.

This species is said (by Banks) to have been reported from Uganda, but I find no reference to that effect.

Locality: Pampanga (Luzon) [*Whitmore*].

MYZORHYNCHUS Blanchard, 1902.

Comp. rend. So. Biol. Paris, xxiii, 795.

nom. nov. for *Rossia* Theob. preocc. Owen 1838 in Mollusca.
Rossia Theob. Jour. Trop. Med., v, 181.
Myzorhynchus Theob. Mon. Culic., iii, 84; pl. v, wing scales.
Id. Theob. gen. Ins. Fasc. 26, p. 9.
The larva of this genus is said to breed mostly in swampy ground.

1. **M. albotæniatus** Theob., 1903.

Mon. Culic., iii, 88 ♀; pl. i, wing; pl. v, wing scales.

Locality: Perak [*Dr. Wright*].

2. **M. annularis** Wulp, 1884.

Notes Leyden Museum, vi, 249 ♂ ♀ (*Anopheles*), and Tijd. v. Ent., xxviii, 80. Pl. iv, 2 (*Anopheles*).

Theobald, in Mon. Culic. i, 142, makes this a sub-species of *sinensis* Wied., but in vol. iii, 90, he notes his error and states that *his* "*annularis* V. d. Wulp" = *vanus* Wlk.

3. **M. barbirostris** Wulp, 1884.

Notes Leyden Museum, vi, 248 ♀ (*Anopheles*), and Tijd. v. Ent., xxviii, 79 ♀; pl. iv, 1 (*Anopheles*).

Anopheles barbirostris Theob. Mon. Culic., i, 146 ♀, fig. 33 head; fig. 24, wing; also see p. 151. Pl. A, wing scales.

Id. id. Giles, Handbk., 2nd Ed., 308 ♂ ♀; pl. viii, 13*a*, wing ♂ ♀.

Id. id. James & Liston, Anoph. Mosq. Ind. 77 ♀, pl. x, i, wing scales; pl. v, larva figs.; col. pl. ii, full ins. ♀.

Myzorhynchus id. Theob. Mon. Culic. iii, 86, fig. 25, larva hairs, pl. iii, wing.

Id. id. Theob. Gen. Ins. Fasc. 26; pl. i, 3 ♀, full ins. col.

Aitken found the larva amongst grass and weeds in rocky pools, in lily ponds, in the public gardens of Lahore. Not common in houses; Capt. James doubts if it carries disease.

LOCALITIES: Sylhet, Jan., Feb., May, June [*Hall*]; Calcutta [*Annandale*, and 13-xi-1905, bred in the Indian Museum]; Port Canning, Dec. 1906 [*Chatterjee*]; Calcutta outskirts, Lahore and Bombay [*James* and *Liston*]; Canara Dist. [*Aitken*]; Selangor [*Wray*]; Upper Burma, June 1894, and in August [*Watson*]; Kuala Lumpur [*Dr. Durham*]; Mt. Ardjoeno (East Java) [*Hekmeyer*]; Papua [*Biro*]; Shaohyling (China); Pampanga [*Whitmore*]; Rizal [*Banks*, *Schultze*]; Manila [*Banks*]; Fort McKinley [*Craig*] all in the Phil. Is. Also occurs in (Old Calabar in April) [Annett] West Africa, and in Japan.

4. **M. minutus** Theob., 1903.

Mon. Culic., iii, 91 ♀.

Described from a unique from Lahore, taken by Dr. Christophers.

5. **M. nigerrimus** Giles, 1900.

Handbk., 1st Ed., 161 ♀ (*Anopheles*).

Theob. Mon. Culic., i, 150.
Giles Handbk., 2nd Ed., 306.
James & Liston Anoph. Mosq. Ind., 79 ♀; col. pl. iii full ins. col.

The larva has been found in deep, shady pools, amongst grass and weed. The adults are said to be less common in houses, and James and Liston assert that the *Filaria bancrofti* can develop in this species. They also are inclined to think that, in addition to *nigerrimus, vanus, minutus, indiensis, pseudopictus, alboannulatus* and *sinensis* may all represent the same species.

LOCALITIES: Naini Tal [*Giles*]; Sylhet (Jan., Feb., May, June) [*Hall*]; Calcutta (7-iv-1899) [*Alcock* and *Daniels*], 7-vii-1907 [*Annandale*]; 22-iii-1907 [*Indian Museum*]; Travancore [*James*]; Port Canning, 6-i-1907 [*Annandale*]; Jalpaiguri [June 1907]. Dacca, Lahore, Madras.

6. **M. plumiger** Donitz, 1901.

Insectenborse, v, 37 (*Anopheles*).

Described by that author from East India and Hongkong.

7. **M. pseudobarbirostris** Ludlow, 1902.

Jour. New Yk. Ent. So., x, 127.

LOCALITIES: Hagonoy (Bulacan) in Luzon (Oct.) [*Dr. Kellogg*]; Cottabato (June) in Mindanao [*Dr. Thornton*]; Pampanga (Luzon) [*Whitmore*].

8. **M. sinensis** Wied., 1828.

Auss. Zweifl. Ins., i, 547 ♂ ♀ (*Anopheles*).

Frnfld. 1867. Ver. zool. bot. Wien., xvii, 449.
Anopheles id. Theob., Mon. Culic. i, 137 ♀; fig. 30, wing scales; pl. xxxvii, 146 ♀, type form, full ins. col.; pl. A, wing scales.
Id. id. Giles, Handbk., 2nd Ed., 305; pl. viii, 9, wing ♀, scales.
Myzorhynchus id. Theob. Mon. Culic. iii, 89, fig. 53, palpus ♀.
Id. id. Giles, Jour. Trop. Med. vii, 365.

Mr. Theobald (who does not appear to have met with a ♂, a sex which apparently has not been seen since Wiedemann's original type) gave as sub-species of *sinensis* (*vide* Mon. i, 140 *et seq.*), *pseudopictus* Grassi, Italy; (*Anoph. pictus* Ficalbi); "*annularis* V. d. Wulp" ♂ ♀ (= *vanus* Wlk.); *indiensis* Theob. Mon. i, 145, and *nigerrimus* Giles.

In the "Genera Insectorum" he admits *pseudopictus* Grassi, and *nigerrimus* Giles, as good species; but sinks his "*annularis* Wulp" as a synonym of *vanus* Wlk., whilst *indiensis* does not appear; the only species of that name in that work being given as a variety of *Nyssorhynchus maculipalpis* Giles, and apparently has nothing to do with *sinensis* Wied.

James has shown that *Filaria sanguinis hominis* will experimentally develop in this species, the larvæ of which were found by the same observer in deep, natural ponds on swampy ground at some distance from houses in Jalpaiguri.

LOCALITIES: Calcutta and Jalpaiguri [*James*]; Ferozepore [*Adie*]; Shaohyling in June (China) [*Cornford*]; Taipo Pokfulam (China) [*Dr. Rees*]; Foochow (August) [*Rennie*]; Tamsui 2-viii-1899 (Formosa) [*Dr. G. Mackay*]; Pampanga (Luzon) [*Whitmore*].

9. **M. umbrosus** Theob., 1903.

Mon. Culic. iii, 87 ♀; fig. (p. 87) wing.

Taken by Dr. Durham in October at Pahang (Fed. Malay States).

10. **M. vanus** Wlk., 1860.

Pr. Linn. So. Lond. iv, 91 ♀ (*Anopheles id.*).

non annularis Wulp. (*vera*) 1884; Notes Leyden Mus. vi, 249.
"*Annularis* V. Wulp." Theob. Mon. Culic. i, 142 ♂ ♀; fig. 32, head; pl. v, 18 ♀, full ins. col. (as *Anopheles sinensis* Wied., sub-species "*annularis* v. d. Wulp"); pl. A, wing scales (as *sinensis* Wd., sub.-sp. *annularis* v. d. Wulp).
Myzorhynchus sinensis annularis. Theob. Mon. Culic., iii, 90; *vide* also Theob. Mon. Culic. i, 151, for comparisons with other species.

The larva of this species has been studied. (*Vide* Theob. Mon. Culic. iii, fig. 4 (p. 18).)

"Walker's types are very damaged, but enough remains to identify the species." (Theob.)

LOCALITIES: Sambalpur (Cent. Prov. Ind.) [*D. O'C. Murphy*]; Quilon (27-vii-1901) [*James*]; Perak [*Wright*]; Taiping [*Wray*]; Madras [*Cornwall*]; Lahore [*Christophers*]; Penang [*Freer*]; Kuala Lumpur [*Durham*]; Luzon, 7-ix-1901 [*Ludlow*]; Bayembang (Pangasinan, Phil. Is.) [*Chamberlain*]; Manila [*McGregor, Wooley*]; Dindings (Straits).

LOPHOCELOMYIA Theob., 1904.

Entom., xxxvii, 12.

Theob. Gen. Ins. Fasc. 26, p. 10.

"Near *Nyssorhynchus*, but so far I have seen no Anopheline approaching it in general appearance." (Theob.)

1. **L. asiatica** Leicester, 1904.

Entom., xxxvii, 13 ♂ ♀.

Types in British Museum. Taken by Dr. Leicester in the "ambang" jungle at Kuala Lumpur in the Federated Malay States.

NYSSORHYNCHUS Blanchard, 1902.

Comp. rend. Soc. Biol. Paris, xxiii, 795.

nom. nov. for *Laverania* Theob., preoc. by Grassi and Feletti, 1900.
Laverania Theob., Jour. Trop. Med.
Nyssorhynchus Theob. Mon. Culic. iii, 92; pl. v, wing-scales.
Id. Theob. Gen. Ins. Fasc. 26, p. 10.

The larvæ are mostly "pot and puddle" breeding species, but some breed in marshes; the adults are mostly domestic, but some are wild. (Theob.)

1. **N. fuliginosus** Giles, 1900.

Handbk., 1st Ed., 160 (*Anopheles*).

Anopheles fuliginosus Giles, Handbk., 2nd Ed., 298 ♂ ♀; pl. viii, 7, wing, palpus ♂ ♀, scutellum scale.
Id. *id.* Theob. Mon. Culic. i, 132 ♀; fig. 27, scutellum and scale; fig. 28, a, wing; pl. i, 3 ♀ full ins. col.
Id. *id.* James. Sci. Mem. Ind. No. 2, fig. 18 (p. 39) larva chars.
Id. *id.* James & Liston, Anoph. Mosq. Ind. 91; pl. v, 2, larva figs; pl. x, 4, wing-scales; col. pl. v, full ins. ♀.
Anoph. jamesii Liston, Ind. Med. Gaz. (1901), p. 411.
non jamesii Theob. I, 134.
Anoph. leucopus Donitz, Insectenborse v, 37.
Nyssorhynchus fuliginosus Theob. Mon. Culic., iii, 93.
Var. *pallida* Theob. *loc. cit.* i, 134; fig. 28 *b* (p. 133) wing.

This species is subject to great variety both in wing and leg markings (Theob.). In some places (Calcutta and Nagpur) it is common in houses, whereas in others it is said to seldom visit them.

The larva has been observed by Capt. James and others. In Bombay it is often found in tanks; in Nagpur and Madras in open tanks, also in grassy or weedy ponds; in the Punjab in shady, weedy pools.

Under natural conditions it is non-malarious, but experimentally, parasites have been demonstrated to develop in it (James); although Theobald (Monog., i, 134) said that up to then "experiments with human malaria (crescent and tertian)" had failed.

LOCALITIES: Sylhet (Jan., Feb., May) [*Hall*]; Kurseong 5,000 ft. [*Indian Museum*]; Ferozepore, all the year round except Jan. and Feb. [*Adie*]; Lahore in June [*Giles*]; Nagpur [*Stephens*]; Goa and the "Madras Coast, several places" [*James*]; Chingelput (Madras) [*Cornwall*]; Quilon [*James*]; Calcutta 7-iv-1899 [*Daniels*], 13-xi-1905 [bred in *Indian Museum*], 6-vii-1907 and 2-viii-1907 [*Annandale*]; Dacca [*Lt.-Col. Macrae*]; Behar [*Cornwall, Green*].

2. **N. jamesii** Theob., 1901.

Mon. Culic., i, 134 ♀ (*Anopheles*); pl. i, 2 ♀, full ins. col.

Anopheles jamesii Giles, Handbk., 2nd Ed., 299, ♀.
Id. id. James Sci. Mem. Ind. No. 2, 41.
Id. id. James & Liston, Anoph. Mosq. Ind. 93; col. pl. vi, full ins. ♀.

Said to be allied to *maculipalpis, theobaldi* and *fuliginosus*, and not to be a common species.

The larva live amongst grass and weeds at the edges of lakes. Captain James reared the species from larvæ in Nagpur.

LOCALITIES: Shahjahanpur in Oct. (Punjab) [*Giles*]; Ferozepore, rare [*Adie*]; Quilon in Feb. and 7-iii-1900 [*James*]; Calcutta, 23-vii-1907 [*Annandale*] Port Canning, Dec. 1906 [*Chatterjee*]; also from Ellichpur in Feb. (Berar), Bombay, Deccan and Ceylon.

3. **N. karwari** James in Theob., 1903.

Theob. Mon. Culic., iii, 102 ♀; l.c. fig. 61 (p. 103) wing.

Anopheles karwari James & Liston, Anoph. Mosq. Ind. 89; pl. xiv, palpus, leg, head, larva; p. 90, fig. of wing.

Near *maculatus*.

LOCALITIES: Karwar in June (Bombay Pres.) [*Cogill*]; Goa in Feb., 2,000 ft. [*Aitken*].

4. **N. maculatus** Theob., 1901.

Mon. Culic., i, 171 ♂ ♀ (*Anopheles maculata*).

Fig. 48, palpus ♂, head ♂, wing, tip of abdomen and various scales.

Anopheles maculatus James, Sci. Mem. Ind. No. 2, 47, fig. 25, wing and leg.
Id. id. Giles, Handbk., 2nd Ed., 301 ♂ ♀; pl. ix, 2, head, wing ♂ palpus ♂.
Nyssorhynchus id. Theob. Mon. Culic. iii, 96.

Described from two ♀ ♀ in Hongkong. Types in Dr. Rees's collection.

It is very near *theobaldi*, of which James and Liston think it may be a variety. The larva lives in shallow pools and marshy grounds on granite soil near Hongkong. James bred it in March from larvæ found in clear, sandy or rocky pools ; it disappearing in April and May ; and he considers it probably not a malaria carrier. In the Duars, the larva occurs in clear pools in rice fields.

LOCALITIES: Lahore, March, April [*Christophers*]; Kurseong [*James*]; Jalpaiguri (N. Bengal), 13-vii-1907 [*Wallich*]; Jeypur Hill Districts [*James*]; Perak [*Wright*]; Hongkong in Sept. and Oct. [*Rees* and *James*] also from Dindings in Nov. (Straits).

5. **N. maculipalpis** Giles, 1902.

Handbk., 2nd Ed., 279 ♂ (*Anopheles*).

Anopheles maculipalpis James and Liston Anoph. Mosq. Ind. 95, pl. iv, larva figs. ; pl. x, 5, wing-scales ; col. pl. vii, full ins. ♀.

Nyssorhynchus id. Theob. Mon. Culic., iii, 96 ♀, fig. 56, antenna ♀, palpus ♀, cross veins ♀; pl. ii, two wings ♀; fig. p. 98, hairs of larva.

Var. *indiensis* Theob. Mon. Culic., iii, 99.

Giles described only the ♂, Theobald's description of the ♀ is from a single, nearly perfect, specimen taken by Grandpre and Daruty.

LOCALITIES: India [*Christophers* and *Stephens*]; Nagpur, Karwar, Goa and Travancore [t, *James* and *Liston*]; Bayembang (Pangasinan, Phil. Is.) [*Chamberlain*]. Also frequents Mashonaland and Mauritius.

6. **N. nivipes** Theob., 1903.

Entom. xxxvi, 258 ♂.

Near *stephensi* and *maculatus*.

Taken by Dr. Durham in January at Kuala Lumpur in the Federated Malay States.

7. **N. philippinensis** Ludlow, 1902.

Jour. New Yk. Ent. So., x, 128 (*Anopheles*) ; also Jour. Amer Med. Assn. (1902) xxxix, 426.

Occurs at San Jose, Abra, in the Philippines [*Banks*].

8. **N. stephensi** Liston, 1901.

Ind. Med. Gaz., xxxvi, 12 (*Anopheles*).

Anopheles stephensi James, Sci. Mem. Ind. No. 2, 45; fig. 23, wing ; fig. 24, larva chars.

Anopheles stephensi Giles, Handbk., 2nd Ed., 331 ♀ (footnote).
Id. id. James ♀ Liston, Anoph. Mosq. Ind. 113; pl. vi, 2, larva figs.; pl. x, 6, wing scales; col. pl. xiii, full ins. ♀.
Nyssorhynchus id. Theob. Mon. Culic. iii, 93 ♀; fig. 54, variation in wing marks; fig. 55, wing; figs. pp. 40 and 47, larval hairs.
Anoph. metaboles Theob. Proc. Roy. So. Lond., lxix, 374 ♀; pl. v, 1, wing ♀.

Captain James found it breeding at Mian Mir in water reserves (used only in case of fire), also in Madras City in almost unused wells.

Experimentally, human malaria parasites have been developed in this species.

LOCALITIES: Mian Mir and Madras City [*James*]; Ferozepore, May to mid-Nov. [*Adie*]; Calcutta, 1-viii-1907 [*Annandale*]; Lushai Hills, Assam, 9-vii-1904 [*Capt. Macleod*]; Karachi "common"; Nagpur and Ellichpur (Berar).

9. N. theobaldi Giles, 1901.

Ent. Month. Mag., xxxvii, 198 ♀ (*Anopheles*).

Anopheles theobaldi Giles, Handbk., 2nd Ed., 300 ♀.
Id. id. Theob. Mon. Culic., ii, 311 (App.) ♀.
Id. id. James & Liston, Anoph. Mosq. Ind., 97; col. pl. viii, full ins. ♀.
Nyssorhynchus id. Theob. Mon. Culic., iii, 95.

In the Punjab the larva occurs in rice fields and streams; James and Liston state that experimentally the species will develop malaria parasites.

LOCALITIES: Ellichpur (Berar) [*Liston*]; Shahjahanpur 19-x-1900 (N.-W. Prov.) [*Giles*]; Dacca [*Macrae*]; Nagpur [*Stephens*]; Sambalpur [*Murphy*]; Lahore in October, also at Bombay and in the Aden hinterland.

10. N. tibani Patton, 1905.

Jour. Bomb. So., xvi, 629 ♂ ♀; pl. B., wing, palpus ♂ ♀, hind leg, egg, head of larva.

The larva breeds in all the rivers and springs up to Jehaf (6,800 ft.), but is found neither in wells, nor near man.

Experiments to develop "*Benign tertian*" failed.

The species is closely related to *theobaldi*.

LOCALITY: Aden hinterland.

11. **N. willmori** James in Theob., 1903.

Theob. Mon. Culic., iii, 100 ♀; fig. 59, palpus ♀, fig. 60, various scales.

Lt. Willmore found the larva in a clear puddle by a spring in Kashmir (4,800 ft.). It is allied to *stephensi* and *maculatus*; Dr. Christophers records it from Lahore.

CELLIA Theob., 1903.

Mon. Culic., iii, 107 ♀.
Theob. Gen. Ins. Fasc. 26, p. 11.

" Easily told by their dense coating of irregular scales, totally unlike a typical Anopheles " [*Theob.*], *vide* Theob. Monog., iii; pl. viii, wing scales.

1. **C. pulcherrima** Theob., 1902.

Proc. Roy. So. Lond., lxix, 396 ♀; pl. v, 2 wings ♀.
Theob. Mon. Culic., iii, 107.

Anopheles pulcherrima James & Liston Anoph. Mosq. Ind., 86, col. pl. iv, full ins. ♀.
Id. *id.* James Sci. Mem. Ind. No. 2, p. 48, fig. 26, wing.
Id. *id.* Giles, Handbk., 2nd Ed., 510 ♀.

Type in British Museum.

Theobald's descriptions are from 3 ♀ ♀ sent by Capt. James and Drs. Christophers and Stephens.

The larvæ have been found during September in an overflow pool of an irrigation watercourse at Mian Mir.

" It appears to be one of the few species which can tide over the Punjab winter in the adult condition (James and Liston).

LOCALITIES: Mian Mir [*James*]; Ferozepore, early July to early Dec. [*Adie*]; Goa [*James & Liston*]; Purneah (N. Bengal) 7-viii-1907, in bedroom [*Paiva*].

2. **C. kochi** Donitz, 1901.

Insectenborse, v, 36 (*Anopheles*).

Anopheles kochi Theob. Mon. Culic., i, 174 ♀; pl. iv, 16 ♀, full ins. col.
Anoph. ocellatus Theob. (MS.) l.c., i, 174 (t. Theob., vol. ii, 306).
Id. *id.* Giles, Handbk., 2nd Ed., 315 ♀; pl. ix, 5, wing ♀, dorsum of thorax.

Theobald's description (in Monog. i, 174) was written to apply to his species in MS. named *ocellatus*, but Donitz's species was published just before, and takes precedence (confirmed by Theob. in vol. ii).

LOCALITIES: Taipang [*Wray*]; Perak [*Wright*]; Singapore [*Biro*]; Sylhet, 4-ii-1905; 7-vi-1905; 31-vii-1905; and 15-xii-1905 [*Hall*]; Padang (Sumatra) and Serang Tjimahi (Java) [*Donitz*]; Philippines.

ALDRICHIA Theob., 1903.

Mon. Culic., iii, 353 (App.).
Theob. Gen. Ins. Fasc. 26, p. 13.

"One of the most marked genera of the Anophelina, the squamose armature of the abdomen exactly resembling *Culex*" (Theob.).

1. A. error Theob., 1903.

Mon. Culic., iii, 353 ♀.

Described from a perfect unique specimen. Locality given as "India, probably Calcutta."

BIRONELLA Theob., 1905.

Ann. Mus. Hung., iii, 69.

"Near *Anopheles*."

1. B. gracilis Theob., 1905.

Ann. Mus. Hung., iii, 69 ♂; fig. 3, scales; pl. ii, wing ♂, pl. iii, wing scales ♂ ("♀" lapsus).

The photo, figure of wing scales, in pl. iii, is marked, "♀". This is an error, as in the text, the author distinctly states he could not find this sex present in the Hungarian Museum Collection, in which are the types (3 ♂ ♂) from which the description is taken.

Taken by Biro Dec. 31st, 1900, at Muina in Papua.

"ANOPHELES" sensu latu.

In Mr. Theobald's revision of the family in Genera Insectorum he includes the following three species which he is unable to place in any of the modern genera.

1. Anopheles vincenti Laveran, 1902.

Comp. rend. So. Biol. Paris, xxiii, 993.

Recorded by Laveran from Tonkin.

Theobald's quotation "1901, vol. 53" is, of course, an obvious error for vol. xxiii.

2. Anopheles formosaensis.

To this name, Theobald simply adds Tsuzuki—whether this is the author, and from what locality it comes, or where described he does not say. I have not met with the name of the species elsewhere.

3. Anopheles deceptor Donitz, 1902.

Beit. Kennt. 3. d. Anoph., p. 60.

Recorded from Sumatra. May belong to *Nyssorhynchus*.

There are two other species of "*Anopheles*" not alluded to in Theobald's revision ("Gen. Ins."); these are:—

4. Anopheles culiciformis Cogill, 1903.

Jour. Bomb. So., xv, 333.

Recorded from India.

5. Anopheles subpictus Grassi, 1899.

Atti. R. Accad. Lincei. Rendic., viii, 1.

"India Orientalis." So given in Kertesz's "Catalogue of Diptera" (I. 254), but I have not seen the species mentioned elsewhere.

MEGARHINUS Rob. Desv, 1827.

Ess. Culic. in Mem. Soc. His. Nat. Paris, iii, 412.
Macq. 1827 Hist. Nat. Dipt.
Wlk. 1848 List. Dip. Br. Mus., i, 1.
Skuse 1889 Pr. Linn. So. N. S. Wales, iii, p. 1720.
Theob. 1901 Mon. Culic., i, 215, fig. 63, various parts insect, fig. 64, map of distribution, p. 218, table of species.
Theob. 1905 Gen. Ins. Fasc. 26, p. 12.

1. M. amboinensis Doles., 1857.

Nat. Tijd. Ned. Ind., xvi, 381 ♂; pl. v, 5 (*Culex* id.).
Giles, Handbk., 1st Ed., 133 (translation of Doleschall).
Id. *id.*, 2nd Ed., 276.
Theob. Mon. Culic., i, 243 ♂.

Not uncommon in the bush in the dry season in Amboina, according to Doleschall. Osten Sacken (Berl. Ent. Zeit., xxvi, 96) questioned if this species was distinct from *immisericors* Wlk., but it is accepted as such by Kertesz (Cat. Dipt.) and Theobald (Gen. Ins.).

An allied species *subulifer* Doleschall (*Culex* id.) is given by Kertesz as a synonym of this species, but Theobald regards it as the same as *immisericors*, and I therefore follow him as the latest authority in this group. Moreover he thinks the present species may be a *Toxorhynchites*.

LOCALITY : Amboina [*t. Doleschall*].

2. M. lewaldii Ludlow, 1904.

Can. Ent., xxxvi, 223 ♂.

The type was bred in the laboratory, but no notes were kept; the specimen is a unique and is perfect. Not mentioned by Theobald in " Genera Insectorum."

LOCALITY : Salog (April), Guimaras Island (Philippines) [*LeWald*].

3. M. minimus Theob., 1905.

Jour. Bomb. So., xvi, 237 ♂; pl. A, fig. 1, palpus, wing, abdomen tip.

Described from a unique ♂ taken in March at Yatiyantota, Ceylon. Theobald ignores this species in the " Gen. Ins."

4. M. splendens Wied., 1819.

Wied. Zool. Mag., iii, 2 (*Culex* id.) ♂.
Wied. 1828 Auss. Zweifl., i, 3 (*Culex*). ♂.
Macq. Hist. Nat. Dipt., i, 33 (*Culex*).
Sch. 1868 Reise Novara 31 (*Megarhinus*).
Wulp. 1881 Dipt. Mid. Sumatra 8 ; pl. i, 2, wing.
Theob. Mon. Culic., i, 235 ♀; pl. viii, 31 ♀, full ins. col.
Giles Handbk., 2nd Ed., 271.

Types in Wiedemann's and Westermann's collections.

LOCALITIES : Java [*Wiedemann*]; Sumatra [*Schiner*]; Singapore [*Wallace*]. Rawas, (Mid. Sumatra) and Batavia [*t. Wulp.*].

TOXORHYNCHITES Theob., 1901.

Mon. Culic., i, 244.
Loc. cit. iii, 120, notes on larva, pupa, etc., of non-oriental species.
Theob. Gen. Ins. Fasc. 26, p. 13.

1. T. immisericors Wlk., 1860.

Pr. Linn. So., iv, 90 ♂ (*Megarhina*).

Megarhinus *id.* Theob. Mon. Culic., i, 225 ♂ ♀; pl. vii; 28 ♂, full ins. col. (*Megarhinus* id).; pl. ix, 33 ♀; full ins. col. (*M. gilesii*).
Id. *id.* Giles, Handbk., 2nd Ed., 273.

Toxorhynchites id. Theob. Mon. Culic., iii, 123, fig. 67, larva, pupa.
Megarhinus "*id.* or *amboinensis* Dol." Os. Sack. Berl. Ent. Zeit., xxvi, 96.
Id. or Giles, Handbk. *id.*, 2nd Ed., 273.
Id. gilesii Theob. Mon. Culic., i, 227 ♂ ♀.
Id. subulifer Doles. 1857 Nat. Tijd. Ned. Ind., xiv, 382; pl. v, 2 (*Culex*).
Id. id. Giles, Handbk., 2nd Ed., 272.
Culex regius Thwaites (1864) Pr. Linn. So. Lond., viii, 102.

This very large and handsome mosquito occurs apparently all over the Oriental region, in parts of India being known as the "stinging elephant mosquito." Mr. Ernest Green of Ceylon has bred it from larvæ living in the collected water in stems of the giant bamboo. The larvæ prey solely on the larvæ of other *Culicidæ*.

The adult shows some variation, and it appears fairly common in Calcutta in particular spots in gardens and on walls and tree trunks during July and August, and both sexes have been taken there frequently by Dr. Annandale. I captured a specimen in a wine shop in Calcutta, July 1904, the only one I have seen alive.

LOCALITIES: Calcutta, July, August [*Annandale and others*]; Upper Burma [*Watson*]; Sikhim, 1,800 feet, June [*Dudgeon*]; Bhim Tal, Sept. 1906 [*Annandale*]; Sylhet, May, June [*Hall*]; Celebes, Mysol, North Ceram and Waigion [*t. Walker*]; Settleberg (Huon golf) (Papua) [*Biro*]; Ceylon [*Hope Coll. Oxford*]: also recorded from Trincomalee Hot Wells, Macassar and Travancore.

2. **T. inornatus** Wlk., 1865.

Pr. Linn. So. Lond., viii, 102 ♂ (*Megarhinus*).

Theob. Mon. Culic., i, 223 ♂ ♀; pl. vii, 26 ♂ 25 ♀ (both full insects coloured, as *Megarhinus* id.).
Megarhinus inornatus Giles, Handbk., 2nd Ed., 271 ♂ ♀.

Theobald's description is from two specimens in the British Museum of which I presume one is Walker's type (♂).

3. **T. leicesteri** Theob., 1804.

Entom., xxxvii, 36 ♂ ♀.

Types in British Museum. Taken by Dr. Durham at Kuala Lumpur.

4. **T. metallica** Leicester in Theob., 1904.

Entom., xxxvii, 37 ♂ ♀.

Types in British Museum. Taken by Dr. Leicester at Kuala Lumpur.

WORCESTERIA Banks, 1906.

Phil. Jour. Sci., i, 779.

Near both *Megarhinus* and *Toxorhynchites*, but quite distinct.

1. W. grata Banks, 1906.

Phil. Jour. Sci., i, 780 ♂ ♀; plate, palpus ♂, genitalia ♂, cross veins ♂ ♀, scales, etc.

The adult does not bite. The species was bred during June.

Types (♂ ♀ No. 6071) in the Entomological Collection, Bureau of Science, Manila.

LOCALITIES: Bago, (150 metres alt.; June and July) (Negros Occidental Philippine Islands) [*Banks*]; and Cebu [*McGregor*], both places in the Philippines.

Sub-Fam. CULICINÆ.

Theob. Gen. Ins., Fasc. 26, p. 14. Chars. of sub-family, also analytical table of 30 genera.
Theob. Mon. Culic., i, 97, table of genera.
Giles Handbk., 2nd Ed., 334, table of genera.

MUCIDUS Theob., 1901.

Mon. Culic., i, 268.

Theob., Gen. Ins., Fasc. 26, p. 17.

A table of species given by Theobald. Monog., i, 269.

1. M. alternans Westw., 1881.

Tr. Ent. So. Lond., iii, 384.

Mucidus alternans Giles Handbk., 2nd Ed., 347 ♂ ♀; pl. xii, 2, wing ♀.
Culex commovens Wlk. Ins. Saunds. Dipt. 432.
C. hispidosus Skuse. Tr. Linn. So. N. S. Wales, p. 1726.

The only oriental locality seems to be Papua [*Hungarian Museum*].

2. M. laniger Wied., 1821.

Dipt. Exot. 9 (*Culex id.*) ♀.

Auss. Zweifl., i, 5 ♀.
Culex laniger Macq. Dip. Ex., i, pt. 2, 176.

Type in Westermann's Collection. Recorded from Java and Coromandel.

3. **M. mucidus** Karsch, 1887.

Ent. Nachr. (1887) 25 (*Culex id.*).

Mucidus-mucidus Theob. Mon. Culic., i, 272 ♀; pl. xi, 42 ♀ full ins. col.; pl. B, wing scales.
Id. *id.* Giles, Handbk., 2nd Ed., 349 ♀; pl. xii, 3 wing ♀.

4. **M. scatophagoides** Theob., 1901.

Mon. Culic, i, 277 ♀; pl. E, wing scales; fig. 81 (p. 278) wing, thorax, scales.

Giles, Handbook, 2nd Ed., 348 ♀; pl. xii, 1,*a*, full ins.; 2,*a*, venation.

An attempt by Major Close to breed the species from eggs laid by a ♀ in captivity, failed. He records that for a week in September in the Police Hospital at Moradabad (N.-W. Prov.), it bit viciously. It is also recorded from Myingan in Burma.

DESVOIDYA Blanchard, 1901.

Comp. rend. So. Biol. Paris, No. 37, liii (*Desvoidea*). nom. nov. for *Armigeres* Theob., preoc.

Armigeres Theob. 1901 Mon. Culic., i, 322.
Desvoidea id. loc. cit., iii, 134.
Desvoidya emendation by Theob. in Gen. Ins. Fasc. 26, p. 17.

1. **D. fusca** Theob., 1903.

Mon. Culic, iii, 135 ♂ ♀. Fig. 75 mid-ungues ♂, palpus ♂; fig. 76, pupa figures.

Theob. Mon. Culic., iii, pl. xvii, larva figs.

Dr. Durham found the larva in a tub, and Miss Ludlow records it as being bred in the Philippines, " from larvæ taken from the water-filled joints of bamboo poles in the fence."

LOCALITIES: Kuala Lumpur [*Dr. Durham*]; Angeles (Pampanga, Phil. Is.) [*Whitmore*].

2. **D. joloensis** Ludlow, 1904.

Can. Ent., xxxvi, 236.

Described by Miss Ludlow as a variety of *fusca*, mentioning that the variation was constant throughout the 23 ♂ ♂ ♀ ♀ examined, and as Banks admits it as a good species, I follow him. Taken by an unrecorded collector at Jolo (Jolo Island, Philippines).

3. **D. obturbans** Wlk., 1860.

Pr. Linn. So. Lond. iv, 91 ♀ (*Culex*).

Armigeres obturbans Theob. Mon. Culic., i, 323 ♂ ♀. Fig. 104, wing; fig. 105, palpus ♂ (incorrect), ungues ♀, ♂ genitalia; fig. 106 ♂ ungues.
Desvoidea obturbans Theob. Mon. Culic., iii, 138, fig. 75, 1 mid ungues ♂; fig. 77, corrected ♂ palpus; fig. 78, ♂ clasper.
Armigeres ventralis Wlk., Theob. Mon. Culic.; pl. xv; 57 ♀ full ins. col.
Id. *id.* Giles, Handbk., 2nd Ed., 385 ♂ ♀; pl. xiv, 11 venation, 12 claws.
Culex ventralis Wlk. 1861. Pr. Linn. So. Lond., v, 144.

The type (♀) is in the British Museum. A common species from the East Coast of India, through the Straits, and up the Chinese Coast. Capt. James has observed the whitish woolly larva breeding in pots and tubs of dirty water in the open and under trees. The adult is common in woods, rarely visiting houses. Miss Ludlow records it as having been bred in the Philippines, from larvæ from deep pools in a clear running stream.

Originally described from Amboina.

4. **D. panalectoros** Giles, 1901.

Jour. Bomb. So. xiii, 608,

and (1901) in Theob. Mon. Culic., ii, 317 ♂ ♀ (*Armigeres*).
Desvoidea panalectoros Theob. Mon. Culic, iii, 136; fig. 75, 3, palpus ♂. Loc. cit. iii; pl. xvii, larva figs.
Desvoidya *id.* Theob. Gen. Ins. Fasc. 26, p. 18.
Armigeres *id.* Giles, Handbk., 2nd Ed., 386 ♂; pl. xiv, 13 venation, 14 head ♂, 15 claws, 16 thorax.

The types are in the Indian Museum, and were captured by Col. Alcock of that Institution, at Calcutta, during the rainy season.

LOCALITIES: Calcutta [*Alcock*]; Perak [*Wright*]; Pampanga (Phil. Is.) [*Whitmore*].

STEGOMYIA Theob., 1901.

Mon. Culic, i, 283.

Theob. loc. cit. tab. spp., p. 285; map of distribution, p. 284.
Theob. Gen. Ins. Fasc. 26, p. 18.
Giles, Handbk., 2nd Ed., 368; table spp. 369.

1. **S. amesii** Ludlow 1903.

Jour. New Yk. Ent. So., xi, 139 (*Stegomyia nivea amesii*).

Described from the Philippines, but I can find no definite data except that Banks includes it in his Catalogue.

NOTE.—Banks mentions in addition to this species a "*Scutomyia nivea* Ludl. (*Stegomyia nivea*)" with exactly the same reference as this species, and adds: "There appears to be a confusion of this species with *Stegomyia amesii* Ludl. in the Genera Insectorum." I have not seen the New York journal, but I infer that Miss Ludlow described two species on the same page, *viz.*, (1) *Stegomyia nivea* Ludl., which Banks places as a good species in *Scutomyia*; and, (2) *Stegomyia nivea amesii* Ludl. (probably intended, to judge by the triplet of names, to be a sub-species), which Banks also ranks as a good species under the title *amesii* only, in *Stegomyia*.

2. **S. annulirostris** Theob., 1905.

Jour. Bomb. So., xvi., 239 ♀.

Described from a unique ♀ from Peradeniya, Ceylon, taken in January.

3. **S. aurostriata** Banks, 1906.

Phil. Jour. Sci., i, 995, ♀.

Type No. 6082 in the Entomological Collection, Bureau of Science, Manila, taken in June on the Canlaon Volcano, Negros Island (Philippines) at an altitude of 760 metres.

4. **S. brevipalpis** Giles, 1902.

Handbk., 2nd Ed., 384 ♂ ♀; pl. xiv, 17, 18, 19, wings, 20 head ♂.
Theob. Mon. Culic., iii, 146 (*Culex id.*) ♂ ♀.

Types in British Museum. Theobald said (Monog. iii, 146) that he had examined the types in the British Museum, and had found them to be not a *Stegomyia* but a typical *Culex*; but (in the Gen. Ins.) he replaces the species in the present genus. The ♀ bites during the daytime in houses.

Recorded in October from Shahjahanpur (N.-W. Prov.).

5. **S. crassipes** Wulp, 1892.

Dip. Sum. Exp. 9, pl. i, 4, head (*Culex*).

Stegomyia crassipes Theob. Mon. Culic. i, 320 ♀; pl. xxxiv, 134 ♀ full ins. col.
Id. *id.* Giles, Jour. Trop. Med., vii, 367.
Id. *id.* Giles, Handbk., 2nd Ed., 381.

Described from 2 ♀ ♀ from Sumatra.

LOCALITIES: Soeroelangoen (Sumatra) (t. *Wulp*); Thayetmyo in August (Upper Burma) [*Watson*]; Pampanga (Phil. Is.) [*Whitmore*].

6. S. fasciata F., 1805.

Sys. Antl. 36 (*Culex*).

Stegomyia fasciata Theob. Mon. Culic., i, 289 ♂ ♀; figs. 86 to 89, var. chars; map of distribution, p. 292; pl. xiii, 49 ♂, 50 ♀, both full ins. col. Pl. B, wing scales; also of a Queensland var.

Id. *id.* Theob. Gen. Ins. Fasc. 26; pl. i, fig. 11, ♀ full ins. col.

N.B.—In this plate are given two full insects, and figures of a thorax and a leg. The full insects figures apply to *fasciata* F., typical form ♂ ♀, the figure of the thorax to the variety *mosquito* Rob. Desv., and the figure of the leg to Theobald's variety *luciensis*.

Stegomyia fasciata Giles, Handbk., 2nd Ed., 372; pl. xiv, 2, venation; 3 thorax.

Synonyms (*Culex*)—

calopus Meig. 1818, Sys. Bes., i, 3.
Desv. 1827, Ess. Culic., 407.
tæniatus Wied. 1828, Auss. Zweifl., i, 10 ♂ ♀.
Konoupi Brullé 1832, Exped. Morea. Ann. So. Nat. Paris, xxiii.
formosus Wlk. 1848, List Dip. Br. Mus. i, 4 ♀.
viridifrons Wlk. 1848, l.c., p. 3, ♀.
inexorabilis Wlk. 1848, l.c., p. 4, ♀.
excitans Wlk. 1848, l.c., p. 4, ♀.
exagitans Wlk. 1856, l.c., p. 430, ♀.
impatabilis Wlk. 1860, Pr. Linn. So. Lond., iv, 91 ♂.
zonatipes Wlk. 1860, l.c., v, 229 ♂.
annulitarsis Macq. 1838, Dip. Ex. Supp., i, 136 ♀.
toxorhynchus Macq. l.c., i, 25.
bancroftii Skuse 1886, Pr. Linn. So., N. S. Wales, iii, p. 1740.
mosquito Arrib. 1891, Dipt. Argent, 60.
elegans Ficalbi 1896, Bull. So. Ent. Ital. (1896), p. 251.
rossii Giles 1899, Jour. Trop. Med., p. 64.
var. *mosquito* Rob. Desv. 1827, Ess. Culic., 407. Theob. Mon. Culic. i, 295; pl. xiii, 50 (the separate figure of thorax only).
luciensis Theob. Mon. Culic. i, 297 ♂ ♀; pl. xiii, 50 (the separate figure of a leg only).
queenslandensis Theob., l.c., i, 297 ♀.

Theobald in his report on the Buda Pesth Museum *Culicidæ* (Ann. Mus. Hung., iii, 73) mentions a var. *mosquito* Arribalzaga as occurring at Port Said and Singapore (collected at both places by Biro, the specimens being in the Hungarian National Museum collection), but in the "Genera Insectorum" he sinks Arribalzaga's "*mosquito*" as an absolute synonym of *fasciata* F., typical form, and gives *mosquito* R. Desv. as a good variety.

This is one of the most variable species in the family.

Banks says "all parts of the tropical world," but this may be doubted, as I can obtain only Biro's record from Oriental latitudes—except those of Banks.

Australian ♀♀ are said to be larger than Asiatic, East Indian or West Indian ones, but Australian ♂♂ are of no larger size than usual. The eggs are laid separately and not in rafts. Dr. Low says they begin to breed the first day they emerge from the pupa, one ♂ fertilising many ♀♀, and pairing by night freely as well as by day. The eggs possess great vitality and do not lose it, even if completely dried for some weeks. He calls it an "essentially domestic mosquito" breeding in any receptacle holding water near the house, and in company with *C. fatigans* Wied.

In the West Indies it bites viciously between 1 and 3 p.m.

LOCALITIES: Singapore and Friedrich Wilhelmshafen (Papua) [both *Biro*]: Pampanga (Phil. Is.) [*Whitmore*]. Also occurs at Port Said and Muscat (Arabia).

Sub-species **persistans** Banks, 1906.

Phil. Jour. Sci., i, 996.

The type ♂ and ♀ of this variety are in the Entomological Collection (Type No. 5773), Bureau of Science, Manila.

He says it is the "most abundant day flying mosquito in this region and a vicious biter, appearing generally, and biting fiercely, just before a storm."

LOCALITIES: Manila, Iloilo and Bago (Negros Is.); (all Phil. Is.) [*Banks*]; Fort McKinley (Phil. Is.) [*Craig*]; and taken by various collectors elsewhere in these Islands.

7. S. gardneri Ludlow, 1905.

Can. Ent., xxxvii, 99 ♂ ♀.

LOCALITIES: Bulaco in August (Mindoro Is. Philippines) [*Gardner*]; Pampanga (Luzon) [*Whitmore*].

8. S. mediopunctata Theob., 1905.

Jour. Bomb. So., xvi, 240 ♀.

Described from a unique ♀ in perfect condition taken in November at Peradeniya (Ceylon).

9. **S. microptera** Giles in Theob., 1901.

Mon. Culic., ii, 281 ♂ ♀ (*Wyeomyia* (?) *micropterus*).
Stegomyia microptera Giles, Handbk., 2nd Ed., 380 ♂ ♀; pl. xiv, 24, head, thorax; 25, head; 26, venation.
Id. *id.* Theob. Mon. Culic., iii, 147 (note).
Culex micropterus Giles Jour. Bomb. So., xiii, 609.

Theobald (Monog., ii, 281 ♂ ♀, fig. 291, wing) publishes Giles's description with "Allahabad and Lucknow, in houses," as data.

Giles suggested that the species belonged to Theobald's *Wyeomyia*, but the latter replied, "Some mistake has been made here; the insect referred to is undoubtedly a typical Culex." In vol. iii (Monog.), p. 147, he writes that "it is now said by Giles to be a *Stegomyia, vide* his Handbk., 2nd Ed., 380." Theobald continues (l.c.), "I have not seen the specimen, which appears to have been lost. Another locality is given, *viz.*, Jhansi." Probably the fact of what is apparently the type being lost, accounts for Theobald not including the species in the "Genera Insectorum." Moreover he speaks of "the specimen," but from Giles's original description (in Theob. Monog., i, 281), the author appeared to have several examples.

LOCALITIES: Allahabad, Jhansi, Lucknow [*Giles*].

10. **S. periskelata** Giles, 1902.

Handbk., 2nd Ed., 371 ♂; pl. xiv, 22, head ♂.

Theobald in Mon. Culic., iii, 145, describes the ♂, but it does not appear in his revision in the "Genera Insectorum."

Recorded from Shahjahanpur (October) in the N.-W. Provinces.

11. **S. pipersalata** Giles in Theob., 1901.

Mon. Culic., ii, 316.

Giles, Handbk., 2nd Ed., 372 ♂; pl. xvi, 1*a*,*b*, venation ♂.

Type in British Museum. The species is ignored by Theobald in the "Genera Insectorum."

LOCALITIES: Jhansi and Gonda (N.-W. Provinces).

12. **S. pseudonivea** Theob., 1905.

Ann. Mus. Hung., iii, 75 ♀.

Described from a unique ♀ taken by Biro in January at Singapore and now in the Hungarian Museum Collection.

13. S. **punctolateralis** Theob., 1903.

Entom., xxxvi, 156, ♂ ♀.

Giles, Jour. Trop. Med., vii, 367.

LOCALITIES: Pampanga (Philippines) [*Whitemore*]; Queensland in January [*Dr. Bancroft*].

14. S. **scutellaris** Wlk., 1859.

Pr. Linn. So. Lond., iii, 77, ♂ (*Culex id.*).
Theob. Mon. Culic., i, 298 ♂ ♀, fig. 91 ♂ ungues; pl. xiv, 53, ♀, full ins. col.

Stegomyia id. Giles, Handbk., 2nd Ed., 374 ♀; pl. xiv, 4, venation, 5 head, thorax ♂.
Culex variegatus Doles. Nat. Tijd. Ned. Ind., xvii, 77.

The larva of this species has been continually observed.

Theobald mentions it as breeding in standing water near houses at 500 feet altitude; Aitken reared it in Bombay, the larvæ living amongst rotten leaves; and he found it abundant in the Canara District, living in forest streams.

One of the most widely distributed species. Mr. Aitken says it bites during the day in the Canara District, whilst Mr. B. G. Corney declares it disappears at night at Fiji (Bera Is.).

Type in British Museum, in good condition.

Mr. Theobald has omitted this species from the "Genera Insectorum." Presumably this is an oversight, as he does not account for the species in any way.

LOCALITIES: Madras and Naini Tal [*Giles* and *Cornwall*]; Canara District [*Aitken*]; Sombalpur (Cent. Prov.) [*Dr. O'C. Murphy*]; Ceylon November and 12-xi-1899 [*Bartholomew*]; Selangor 28-x-1899 "very common" [*Butler*]; Upper Burma (March) [*Watson*]; Siam (abundant) [*Skeat*]; Penang [*Freer*]; Perak [*Wright*]; Singapore, 4-ix-1899 [*Raffles Museum*], also "27-vi-1899," and from "Singapore" [*Biro*]; Celebes and Aru [*t. Walk.*]; Ins. Deslacs and Ins. Graget [*Biro*]; Selve, Berlinhafen, Stephansort and Muina (all Papua) [*Biro*]; Amboina [*t. Doles.*]; Hongkong 27-ix-1899 [*Ford*]; Foochow 9-viii-1900 [*Rennie*]; Shaohyling (China) (*Cornford*); Tamsvi (*Formosa*) 2-viii-1899 [*Mackay*]; Japan [*Wood*]; Bayambang (Pangasinan, Phil Is. [*Chamberlain*]; North Borneo. Outside the Orient it occurs in Mauritius, 22-xi-1899 [*Sir Ch. Bruce*]; Fiji 30-xii-1899 [*Black*]; Victoria (Seychelles) [*Dr. Denman*]; and on Christmas Island [*Dr. Durham*].

Sub-species **samarensis** Ludlow, 1903.

Jour. New Yk. Ent. So., xi, 138.

also in Can. Ent., xxxvi (1904), 71 for difference between typical form (*scutellaris* Wlk.) and this var.

Banks says that *scutellaris* Wlk. (typical) has not been seen by him from the Philippines, but that this variety is widespread there, and that he has bred several varieties of it, all reared from the same lot of eggs. He suggests " intergradation between (*scutellaris* and *samarensis*."

Although Theobald places this sub-species under *Scutomyia notoscripta*, Skuse, I retain it under *scutellaris* Wlk., following the more recent authority of Banks (Phil. Jour. Sci., i, 985) who raises it to the dignity of a species.

LOCALITIES: Samar, Leyte, Mindoro, Iloilo, Negros (all Phil. Is.) [*t. Banks*]; Manila, Fort McKinley [*Craig*].

NOTE.—**albopictus** Skuse, Ind. Mus. Notes, iii, 20.

I find some difficulty in deciding where to place the above form.

Theobald in his Monograph (i, 298) sinks it as a synonym of *Stegomyia scutellaris* Wlk., as does Giles (Handbk., 2nd Ed., 374). Yet in the Genera Insectorum, Theobald omits *scutellaris* Wlk. altogether (this must surely be an omission by error), and gives *albopictus* Skuse as a synonym of *Scutomyia notoscripta* Skuse. Moreover, his reference to Skuse's description in "Ind. Mus. Notes" should be vol. iii, pt. 5, and not " vol. 35."

Whether a good species or whether synonymous with *scutellaris* or *notoscripta*, the form *albopictus* is common throughout the summer in Calcutta, I myself having bred it during August from larvæ found in the bathroom. They metamorphosed quite readily in an empty biscuit tin, and I believe developed a second generation therein, but I could not be quite certain that this latter was not due to other specimens obtaining access to the water.

Dr. Annandale took it at Bhim Tal (Kumaon 4,500 ft.) in Sept. 1906, where it was freely breeding in water butts near European houses, also in cavities holding water in jungle trees. From a comparison of the descriptions, and an examination of specimens it seems to be a form of *scutellaris* Wlk., under which specific name I therefore retain it.

15. **S. sexlineata** Theob., 1901.

Mon. Culic., i, 308 ♀, fig. 94, head, thorax, abdomen, ungues, wing scales, etc.

Giles Handbk., 2nd Ed., 377.
Id. Jour. Trop. Med., vii, 367.

Described by Theobald from a unique perfect ♀, taken at Agua Santa (Trinidad) in December. Giles is uncertain of the identity of his species with Theobald's.

Taken by Whitmore at Angeles (Pampanga, Phil. Is.).

16. **S. thomsoni** Theob., 1905.

Gen. Ins. Fasc. 26, p. 18.

Theobald does not mention the sex of this species, which comes from the North-West Provinces of India. The "description" is confined to five lines.

17. **S. w-alba** Theob., 1905.

Ann. Mus. Hung., iii, 74 ♀, fig. 4, thorax, head, femur.

Type in Hungarian Museum. Described from a perfect unique ♀, which was taken by Biro at Matheran (India, near Bombay) at an altitude of 800 metres.

NOTE.—The following species, described as *Stegomyia* are not accounted for by Theobald in his "Gen. Ins." revision.

18. **S. desmotes** Giles, 1904.

19. **S. leucomeres** Giles, 1904.

20. **S. striocrura** Giles, 1904.

All three species are described in the "Jour. Trop. Med." VII, 367, and all three were taken by Whitmore at Angeles (Pampanga, Phil. Is.).

SKUSEA Theob., 1903.

Mon. Culic., iii., 291;
also in Gen. Ins. Fasc. 26, p. 19.

1. **S. culiciformis** Theob., 1905.

Ann. Mus. Hung. iii, 77 ♀; pl. i, wing; pl. iv, wing scales.

Described from a unique ♂ which is in the Hungarian Museum, and was collected by Loria on the Paumomu River in Papua.

2. **S. diurna** Theob., 1903.

Entom., xxxvi, 259 ♀.

Described from a single perfect ♀ taken by Dr. Durham in September at the hospita reservoir at Jugra (Kuala Lumpur). It is a day flyer and near *S. multiplex.*

3. **S. funerea** Theob., 1903.

Mon. Culic., iii, 292 ♀, fig. 164 (p. 292), head, abdomen.

Types in British Museum.

Var. **ornata** Theob., 1905.

Ann. Mus. Hung., iii, 79, ♀; pl. i, wing.

Described from 8 ♀ ♀. Captured by Biro at Sattelberg (Huon Golf) and Friedrich Wilhelmshafen, both places in Papua.

4. **S. multiplex** Theob., 1903.

Mon. Culic., iii, 293 ♀, fig. 165, head ungues.

Original description from 3 ♀ ♀ from Australia, but Theobald found it in the Hungarian Museum from four Papuan localities (the specimens collected by Biro), *viz.*, Friedrich Wilhelmshafen, Stephansort, Muina and Ins. Graget.

SCUTOMYIA Theob., 1904.

Entom., xxxvii, 77.

Has affinities with *Stegomyia*, *Macleaya* and *Leicesteria*.

1. **S. albolineata** Giles, 1901.

Jour. Bomb. So., xiii, 609.

India. I can find no further data.

2. **S. albolineata** Theob., 1904.

Entom., xxxvii, 77 ♀.

Apparently a case of a second species of the same name, as Theobald does not account for Giles' species in any way in the Genera Insectorum.

Described from a unique ♀ taken by Dr. Leicester during June in jungle, six miles from Kuala Lumpur.

Type in British Museum. " Close to *scutellaris* Wlk."

3. **S. nivea** Ludlow, 1903.

Jour. New Yk. Ent. So., xi, 139 (*Stegomyia id.*).

Federated Malay States and Philippine Islands.
N.B.—Vide Note under *Stegomyia amesii.*

4. **S. notoscripta** Skuse, 1889.

Pr. Linn. So., N. S. Wales, iii, p. 1738 (*Culex*).

Sub-species **samarensis** Ludl., 1903.
Jour. N. Yk. Ent. So., xi, 138.

Philippine Islands.

Mr. Theobald in the " Gen. Ins." gives *albopictus* Skuse as a synonym of *notoscripta* Skuse. *Vide* my notes under *Stegomyia scutellaris* Wlk.

5. S. sugens Wied., 1828.

Auss. Zweifl., i, 545 ♀ (*Culex*).

Theob. Mon. Culic., i, 300.
Patton Jour. Bomb. So., xvi, 634; pl. D, head of larva, male clasper.
Giles, Handbk., 2nd Ed., 375 ♂ ♀.

First described by Wiedemann from West and Central Africa, but it has been found quite recently by Patton in Arabia, breeding in tanks, barrels, wells or any still water, being a very common species at Aden, its bite being very irritating. The ♂ is said not to bite.

LEICESTERIA Theob., 1904.

Entom., xxxvii, 211.

Theob., Gen. Ins. Fasc. 26, p. 20.

Near *Eretmapodites, Macleaya, Scutomyia,* etc.

1. **L. longipalpis** Leicester in Theob., 1904.

Entom., xxxvii, 211 ♂ ♀.

Types in British Museum. Taken at Kuala Lumpur by Dr. Leicester.

HULECOETOMYIA Theob., 1904.

Entom., xxxvii, 163.

Theob., Gen. Ins. Fasc. 26, p. 20.

These *Culicidæ* have the appearance of *Stegomyiæ.*

1. **H. pseudotaeniata** Giles, 1901.

Entom., xxxiv (*Stegomyia*).

Theob. Mon. Culic., i, 312 ♀, fig. 96, thorax, head ♀, wing scales.
Larva descr. loc. cit., i, 314; iii, fig. 16 (p. 28), larva.
Stegomyia id. Giles, Handbk., 2nd Ed., 379 ♂ ♀; pl. xiv, 8, venation; 9, body; 10, larva.

Apparently a hill species. Theobald says it occurs in May; Banks found it common in January at the Manila Waterworks at Rizal, and he bred the species under similar conditions to those of Giles, who took it in the hills.

LOCALITIES: Bakloh (Punjab) and Lower Himalayas 6,000 to 8,000 feet, Naini Tal [*Giles*]; Manila [*Banks*].

2. **H. trilineata** Leicester in Theob., 1904.

Entom., xxxvii, 163 ♂ ♀.

Types in British Museum.

LOCALITY: Kuala Lumpur in April [*Leicester*].

PHAGOMYIA Theob., 1905.

Gen. Ins. Fasc. 26, p. 21.

1. **P. gubernatoris** Giles, 1901.

Entom., xxxiv, 194 ♀ (*Stegomyia*), and Jour. Bomb. So., xiii, 607.

Theob. Mon. Culic., i, 314 ♀, fig. 97 (p. 315), thorax ♀.
Giles, Handbk., 2nd Ed., 380 ♀.

Recorded from Allahabad (July) and "North India." The single specimen forming the type was accidentally damaged, after being described [*Giles*].

HOWARDINA Theob, 1903.

Mon. Culic., iii, 287; pl. xv, wing scales.

Theob., Gen. Ins. Fasc. 26, p. 21.

1. **H. greenii** Theob., 1903.

Mon. Culic., iii, 289 ♀, fig. 160 (p. 289), head, fig. 161, wing.

Described from a unique.

LOCALITY: Peradeniya (Ceylon) in Feb.

2. **H. himalayana** Giles, 1904.

Jour. Trop. Med., vii, 384.

Recorded from Naini Tal.

DANIELSIA Theob., 1904.

Entom. xxxvii, 78.

Theob. Gen. Ins. Fasc. 26, p. 21.

Near *Scutomyia*, *Macleaya* and *Catageiomyia*.

1. **D. albotaeniata** Leicester in Theob, 1904.

Entom., xxxvii, 111 ♂ ♀.

Bred in April by Dr. Leicester from larvæ taken in bamboo jungle six miles from Kuala Lumpur. Resembles *Stegomyia nivea*. Types in British Museum.

LEPIDOTOMYIA Theob., 1905.

Ann. Mus. Hung., iii, 80, and Gen. Ins. Fasc. 26, p. 22.
"Intermediate between *Culex* and *Stegomyia*."

1. L. alboscutellata Theob., 1905.

Ann. Mus. Hung., iii, 80 ♀

Described from two ♀ ♀. Types in the Hungarian National Museum at Buda Pesth.

LOCALITIES: Simbang (Huon Golf) and Friedrich Wilhelmshafen; both in Papua and collected by Biro.

2. L. magna Theob., 1905.

Gen. Ins. Fasc. 26, p. 22.

Recorded from Bombay.

THEOBALDIA Nev. Lemaire, 1902.

Comp. rend. Soc. biol. Paris (1902).

Theob. Mon. Culic., iii, 148; pl. x, wing scales, var. spp.
Theob. Gen. Ins. Fasc. 26, p. 23.

1. T. annulata Schrk., 1776.

Beitr. z. Naturg. 97 (*Culex*).

Culex annulatus Fab. Ent. Sys., iv, 400 (Culex).
Id. *id.* Meig. Sys. Besch., i, 3.
Id. *id.* Macq. Hist. Dipt., i, 35.
Id. *id.* Sch. F. Austr., ii, 626.
Id. *id.* Zett. Dip. Scand., ix, 3640.
Id. *id.* V. Wulp. Dip. Neer, 325.
Id. *id.* Theob. Mon. Culic., i, 331 ♂ ♀, fig. 108, abd. segments, ungues ♂ ♀, palpus ♂; pl. xv, 58, full ins. col.
Id. *id.* Giles Handbk., 2nd Ed., 391; pl. xv, abd. seg.; claws ♂ ♀, wing ♀; head ♂; genitalia ♂.
Theobaldia id. Theob. Gen. Ins. Fasc. 26; pl. i, 12 ♀ full ins. col.
Culex affinis Stephens 1825, Zool. Jour. No. 1 (type in Hope Coll., Oxford).
C. variegatus Schrk. 1781, Enum. Ins. Austr. 482.

Ficalbi says it does not bite man or animals, but feeds on plant juices. This author and Giles have considered *Culex penetrans* Rob. Desv. a variety of *annulata*, but Theobald (Monog. i, 334) thinks it distinct, adding that both sexes hybernate, and that he has taken it (presumably in the adult stage) at all seasons of the year, but gives no data.

LOCALITIES: Punjab (November), Bakloh (Punjab), 5,000 ft. [*Lindesay*]. The species is common in Europe from April to October, and it also occurs in North America.

2. **T. spathipalpis** Rond., 1886.

Prod. Dipt. Ital., i, ♀ (*Culex*).

Theob. Mon. Culic, i, 339 ♂ ♀; iii, 154 ♀; pl. x, wing scales.
Giles Handbk., 2nd Ed., 392 ♂ ♀; pl. xv, 23, wing ♀, 24, head ♂; 25, genitalia ♂.
Ficalbi Venti. spec. Zan. Ital., p. 146, in Bull. Soc. Ent. Ital.

A south European species, occurring from Italy through Cyprus and Palestine to North India, being recorded from Gibraltar in September and from India in June and July. Ficalbi describes the ♂.

Giles thinks this species may be identical with *longiareolatus* Macq., in which case the latter name takes precedence.

Theobald mentions receiving a ♂ from India, but gives no locality. Dr. Grabham, writing from Madeira, says it is not found in houses, but that he has bred them from larvæ found in great abundance in stagnant water, especially horse ponds.

Giles records finding the species in a bathroom at Naini Tal (7,000 ft.), this being the only definite oriental locality I can find. Outside this region it occurs at Cyprus (5,000 ft.), S. Africa (1,300 ft.), Algeria, Teneriffe, Madeira, etc.

PECOMYIA Theob., 1905.

Jour. econ. biol., i.

1 **P. maculata** Theob., 1905.

Jour. econ. biol., i; pl. iv, 7.

Described from India.

PSEUDOGRABHAMIA Theob., 1905

Jour. Bomb. So., xvi, 243.

1. **P. maculata** Theob., 1905.

Jour. Bomb. So., xvi, 243 ♂ ♀.

Described from 1 ♂ and 2 ♀ ♀, perfect specimens from Galgamuwa, Ceylon (August).

GRABHAMIA Theob., 1903.

Mon. Culic., iii, 243 ; pl. xi, wing scales.

Theob. Gen. Ins. Fasc. 26, p. 23.

1. G. ambiguus Theob., 1903.

Mon. Culic., iii, 248 ♂.

A unique, taken by Capt. James in July at Quilon (Travancore, S. India).

2. G. deniedmanni Ludlow, 1904.

Can. Ent., xxxvi, 234.

Philippines.

3. G. ochracea Theob., 1905.

Jour. econ. biol., i, 25.

India.

? 4. G. sollicitans Wlk., 1856.

Ins. Saunds. Dipt., 427.

Theob. Mon. Culic., i, 368 ♀ ; pl. xvi, 64 ♀ ; full ins. col.
Id. id. iii, fig. 130 (p. 248), wing ♀ .

This species may possibly not be oriental, being mainly a North American one. I include it on the ground that an example from Formosa received by Theobald appears to him to be probably *sollicitans*.

The larva breeds in brackish water and is common on the Atlantic seaboard of America.

5. G. spenceri Theob., 1901.

Mon. Culic., ii, 99 ♀ ; pl. xxvi, 104, full ins. col. (*Culex*).
Theob. loc. cit. ii, fig. 198 (p. 100) wing abdominal segment, base of antennæ.
Grabhamia spenceri Theob. loc. cit. iii, 250.
Culex *id.* Giles Handbk., 2nd Ed., 431.

Theobald quotes this as from the Philippines, although it is a North American species, but Banks doubts its occurrence in those Islands. (*Vide* Phil. Jour. Sci. i, 986.)

Theobald describes a var. *idahoensis* from Idaho in Monog. ii, 250.

LOPHOCERATOMYIA Theob., 1905.

Jour. Bomb. So., xvi, 245, and Ann. Mus. Hung., iii, 93.

1. **L. brevipalpus** Theob., 1905.

Ann. Mus. Hung., iii, 96 ♂, fig. 9 (p. 96),
palpus ♂, proboscis base of antennæ, ungues.

A unique specimen, in the Hungarian Museum taken by Biro at Singapore.

2. **L. fraudatrix** Theob., 1905.

Ann. Mus. Hung. iii, 94 ♂ ♀, fig. 7 (p. 94),
palpus ♂ ♀, fig. 8, antennal organs.

Types in Hungarian Museum. Described from a good series of both sexes.

LOCALITIES: Friedrich Wilhelmshafen and Stephansort (both Papua).

3. **L. uniformis** Theob., 1905.

Ann. Mus. Hung., iii, 93 ♂ ♀.

Pl. A, 3, antenna; pl. B, 4, palpus.

Described from 2 ♂ ♂ and several ♀ ♀.
Recorded from Peradeniya (Ceylon) during May.

CULEX Linn., 1758.

Linn. Sys. Naturæ, Ed. x, 602.

Meig. 1818, Sys. Besch., i, 1.
Macq. 1834, Hist. Nat., i, 33.
Sch. 1864, Fn. Aust., ii, 625.
V. Wulp 1877, Dip. Neer, 323.
Theob. 1901, Mon. Culic., i, 326.

Culex, restricted by Theobald, Gen. Ins. Fasc. 26, p. 24.

1. **C. albolineatus** Giles, 1902.

Handbk., Gnats, 2nd Ed., 430 ♀: pl. xvii, 10 a, venation ♀.

Theob. Mon. Culic., iii, 192 ♀.

Described from a single ♀ taken in a bungalow.

LOCALITY: Shahjahanpur (N.-W. Prov.), Oct. 20th.

2. **C. angulata** Theob., 1901.

Mon. Culic., ii, 324 ♀.

Very near *fatigans* Wied. Described from 2 ♀ ♀ in Col. Giles's coll., taken by him in June at Naini Tal (4,000 ft.).

3. **C. annuliferus** Ludlow, 1903.

Jour. New Yk. Ent. So., xi, 141 (*annulifera*).

Theobald's reference to vol. 2 instead of xi is an error. (Gen. Ins.)

LOCALITY: Bayembang (Pangasinan Phil. Is.) [*Chamberlain*].

4. **C. annulus** Theob., 1901.

Mon. Culic., i, 358 ♀.
Giles Handbk., 2nd Ed., 405 ♀.

Described from several ♀ ♀ in Dr. Rees's collection.

LOCALITIES: Tai Po (Pokfulam), Hongkong, Straits (Dindings, Oct. to Dec.), Lamma.

5. **C. biroi** Theob., 1905.

Ann. Mus. Hung., iii, 82 ♂ ♀; pl. i, wing ♂ ♀.

Closely allied to *C. vishnui* Theob. Types in Hungarian Museum.

LOCALITY: Bombay [*Biro*].

6. **C. caecus** Theob., 1901.

Mon. Culic., i, 413 ♀, fig. 147, head; fig. 148, scutellum and scales; pl. xx, 77, full ins. col.

Giles, Handbk., 2nd Ed., 415 ♀.

LOCALITIES: Selangor 28-x-1899 [*Butler*]; Klang Mangrove Swamps.

7. **C. cantans** Meig., 1818.

Sys. Besch. i, 6.

C. stimulans Wlk. List. Brit. Mus. Dip. i, 4 ♀.
C. fumipennis Steph. Zool. Jour. i, 453.

Culex maculatus Meig. is erroneously given as a synonym by Theobald in Proc. Roy. So. Lond., lxix, 388. Walker's species was described from Nova Scotia.

LOCALITY: Coonoor, 6,000 ft. (Nilgiri Hills), North India [*Dr. Price*].

8. **C. concolor** Rob. Desv. 1825.

Mem. So. His. Nat. Paris, iv, 405.

Theob. Mon. Culic., ii, 107 ♂ ♀, fig. 203 ♂, palpus.
Id. id. Pl. xxviii, 109 ♂, 110 ♀, both full ins. col.
Giles, Jour. Trop. Med., vii, 368.
Id. Handbk., 2nd Ed., 454 ♂ ♀; pl. xvii, 8 *a,b*, venation ♂ ♀.

Generally distributed through India and the Straits, common during the rains. Theobald says that owing to the type having apparently been lost, a comparison is impossible, but the species identified by him with it is generally known as Desvoidy's *concolor*. The original description is too meagre for satisfactory determination, and Theobald and Banks both concur in considering it must be removed from the genus *Culex*.

Patton found it breeding in a tank in the Aden hinterland, and Capt. James and Aitken have also studied the larvæ (Theob. Monog., iii, 231) which voraciously fed on other *Culicidæ* larvæ and were, moreover, cannibalistic. They come from grassy pools and (occasionally) wells. A species named "*C. fuscanus*" amongst the old specimens at the British Museum is identified as *concolor* by Theobald.

LOCALITIES: Sylhet 1-ii-1905 and 1-xii-1904 [*Hall*]; Purneah (N. Bengal), 6-viii-1907 [*Paiva*]; Rajmahal (Bengal) 1-viii-1907 [Ind. Mus. Coll.]; Damukdia (E. Bengal) 22-vii-1907 [Ind. Mus. Coll.]; Calcutta, common July, Aug. [*Annandale*]; Gopkuda Is., Chilka Lake, Orissa (E. Coast, India), August 1907 [Ind. Mus. Coll.]; Canara District [*Aitken*]; Quilon [*James*]; N.-W. Provinces [*Giles*]; Madras, 25-xi-1900 [*Cornwall*]; Mozufferpur (Behar, Bengal) [*Green*]; Upper Burma (August) [*Watson*]; Selangor, 28-x-1899 [*Butler*]; Kuala Lumpur [*Durham*]; Perak, 22-xi-1899 and 21-xii-1899 [*Wray* and *Wright*]; Hongkong [*Rees*]; Pampanga (Phil. Is.), [*Whitmore*]; also Foo Chow in China.

9. C. fatigans Wied., 1828

Auss. Zweifl. i, 10 ♂ ♀.

Theob. Mon. Culic., ii, 151 ♂ ♀, fig. 234 ♂, wing, fig. 235 ♂ genitalia, fig. 236, wings; p. 155, map of distribution; pl. xxix, 114 ♂, 115 ♀, both full ins. col.; pl. D, wing scales.
Id. id. ii, 156 *et seq.*, long list vars. and locs.; fig. 238, 10 variations of wings; as an intermediate host, p. 161.
Id. Gen. Ins. Fasc. 26; pl. ii, 2 ♀, full ins. col.
Giles Handbk., 2nd Ed., 438 ♂ ♀ fig. 45, wings, head, etc., p. 440, list of sub-species.
Culex æstuans Wied. Auss. Zweifl., i, 11.
? *C. pungens* Wied., l.c. i, 9.
C. pallipes Meig. Sys. Besch. Suppl. (1838).
C. anxifer Coquerel (Big.) Ann. So. Ent. Fr. (1858).
C. skusii Giles, Handbk., 1st Ed., 292.
Heteronycha dolosa Arrib. Dipt. Argent, p. 56.
? *Culex macleayi* Skuse Pr. Linn. So. N. S. Wales (1896), p. 1745.

Sub. sp. **luteoannulatus** Theob. Mon. Culic., ii, 159.
Id. **trilineatus** *id.* l.c., ii, 150.
id. Giles Handbk., 2nd Ed., 464 ♀ (Thayetmyo, Upper Burma).

The characters of these two subspecies are defined by Theobald but no special localities are given.

If *Culex pungens* of Wiedemann is identical with this species, that name takes precedence. Type presumably in Wiedemann's coll. A widely distributed, common species throughout the Orient, and occurs as far north as Italy. Patton reports it as very common in the Aden hinterland, breeding everywhere in springs, wells and puddles. Banks describes it as the most common night mosquito in the Philippines, hiding during the day in clothes. Dr. Low has seen them pairing by night.

LOCALITIES: Naini Tal [*Giles*]; Sambalpur [*Murphy*]; Etawah, (N.-W. Prov.) [*Maj. Scotland*]; Mozufferpur (Behar, Bengal), [*Green*]; Calcutta 6-iii-1899 [*Daniels*; also by *Dr. Annandale*]; Madras 12-xii-1899 [*Goodrich*]; Madras [*Biro*]; Quilon [*James*]; Kurmregalla, Badulla, Balangoda and Keleni Valley (all four in Ceylon; Jan., March and November, taken by Green); Straits (Dindings) [*Wray*]; Perak [*Wright*]; Singapore, 4-ix-1899 and July [*Hanitsch* and *Biro*]; Papua (Friedrich Wilhelmshafen, and Stephansort) [*Biro*]; Hongkong, 8-i-1900 and July [*Ford*]; Foo Chow [*Rennie*]; Shaohyling (China) [*Cornford*]. Also occurs in very many places in North, Central and South America, many West India Islands, Africa, Fiji, etc., etc.

10. C. foochowensis Theob., 1901.

Mon. Culic., ii, 137 ♂ ♀.

Fig. 224, wing ♀, cross veins, scutellum, ungues ♂, fig. 225, palpus and proboscis ♂, genitalia, abdomen, bristles and wing scales.

An August species from Foo Chow (China); [*Rennie*].

11. C. fragilis Ludlow, 1903.

Jour. New Yk. Ent. So., xi, 143 ?.

Philippines.

12. C. fuscanus Wied., 1828.

Auss. Zweifl., i, 6.

Theob., Mon. Culic., ii, 167.
Id. Gen. Ins. Fasc. 26, p. 30 (quotation incorrect).
Giles, Handbk., 2nd Ed., 455 (no sex given).

The author gives no sex, nor any reference to the type.

Theobald's references to "*C. fuscanus* Wied." are not at all definite. Under his accepted species of *Culex* (*sensu strictu*), he gives "*fuscanus* Wied. 1821, Dip. Ex. p. 9," adding East India, Malacca, Singapore and Sarawak as localities (the latter three, probably on the authority of Walker). Then under his " species unidentifiable, except from types," he places " *C. fuscanus* Wied., 1838, Dip. Ex. 4th supp., p. 9." First of all, the two quotations, by their similarity, appear to refer to the same reference, but, apart from that, Wiedemann in his " Auss. Zweifl." (1828), in describing the species (i, p. 6) does not give any earlier reference, as is usual with him when dealing with species previously described by him elsewhere. This makes me doubt the reference to " Dip. Ex.," more especially as Van der Wulp's Catalogue quotes the " Auss. Zweifl." description as the original one. By the way, Theobald's 2nd quotation is not an error for Macquart's " Dipt. Exot.," as this latter author does not mention the species at all. I therefore include the species *fuscanus* as a good one under Wiedemann's " Auss. Zweifl." reference and under *Culex*. " No specimen has yet been received at the British Museum answering to the description of this species." (Theob.)
LOCALITIES : E. India, Singapore, Malacca, Sarawak.

13. **C. gelidus** Theob., 1901.

Mon. Culic., ii, 20 ♀; pl. xxiv, 93 ♀, full ins. col.; fig. 158, thorax and hind tarsus.

Giles, Handbk., 2nd Ed., 421 ♀.
Theob. Mon. Culic., ii, 20 ♀, fig. 158, thorax and hind tarsus.

Described from a single perfect ♀ taken by Mr. Butler amongst plantains, Oct. 23rd, 1899, in Selangor.

The species is said to be near *C. confirmatus* Arrib.

What appears to be the ♂ of the typical form (hitherto undescribed) was captured at light by Dr. Annandale in Calcutta, 30-vii-1907, and is now in the Indian Museum collection. During July and August this year (1907) this gentleman has taken both sexes fairly commonly on mossy walls of gardens adjoining the Museum.

LOCALITIES : (Typical form) Purneah (N. Bengal), 6-viii-1907 [*Paiva*]; Peradeniya (July and Sept.) and Kelani Valley (both Ceylon) [*Green*]; Selangor [*Butler*]; Dindings (Straits) in November; Bayembang (Pangasinan, Phil. Is.) [*Chamberlain*]; Perak, Dacca, Calcutta.

Var. *sinensis* Theob., 1903. Monog. (iii, 180 ♀).

This variety taken by Mr. Cornford at Shaohyling, China.

Sub. species **cuneatus** Theob., 1901.

Mon. Culic., ii, 22 ♀, fig. 159, wing, head, proboscis, abdomen marks.

Culex gelidus cuneatus Giles, Jour. Trop. Med., vii, 368.

Banks says it is a fairly common mosquito, flying at early evening.

LOCALITIES: Calcutta, July, Aug. [*Annandale*]; Quilon in July [*James*]; Ceylon [*Green*]; Taipang (Perak), 21-xii-1899 [*Wray*]; Manila [*Banks*]; Pampanga (Phil. Is.) [*Whitmore*].

14. C. gnophodus Theob., 1903.

Mon. Culic., iii, 163 ♀.

Closely related to *microannulatus*. Described from a unique from Dindings (Straits), taken in November.

15. C. halifaxii Theob., 1903.

Mon. Culic., iii, 231 ♀.

The type is unique, and from Dindings (Straits) in December.

16. C. hirsuteron Theob., 1901.

Mon. Culic., ii, 98 ♀; fig. 196, ungues ♂, fig. 197, wing ♀.

Theob. Gen. Ins. Fasc. 26, p. 27.
Culex hirsuteros Giles, Handbk., 2nd Ed., 451.
Id. *id.* Jour. Trop. Med., vii, 368.

Described from 4 specimens from Virginia sent by Prof. Howard of the United States National Museum. I include it in this Catalogue provisionally. Banks includes this species from the Philippines in his Catalogue, but doubts the identity of Giles's species with Theobald's American species from Virginia. I find no other record of any oriental locality.

LOCALITIES: Pampanga [*Whitmore*]. Also Virginia, U.S.A.

17. C. hirsutum Theob., 1901.

Mon. Culic., i, 392 ♂ ♀; pl. xx, 80 ♀, full ins. col.; fig. 137, palpus ♂, apex antennæ ♂.

Types in British Museum. Theobald gives the Philippines as its habitat (Gen. Ins.), but Banks's catalogue ignores it.

18. C. impellens Wlk., 1860.

Pr. Linn. So. Lond., iv, 91 ♀.

Theob. Mon. Culic., i, 362 ♀, fig. 122, head, 123, wing.
Id. l.c. iii, 161 ♂, descr.
Giles, Handbk., 2nd Ed., 405 ♂ ♀; pl. xvi, 3*a*, head, *b*, venation ♂.

Theobald feels certain of having recognised this species correctly, although the thorax and wings are all that is left of the type. It is near *sitiens* and *microannulatus* ; Dr. Durham has observed the larva. " Bites and breeds to a moderate extent through the cold weather in the N.-W. Provinces and Punjab " (Giles).

LOCALITIES : Kuala Lumpur in July [*Durham*] ; Perak [*Wray, Wright*] ; Kelani Valley, Batticolora in April (Ceylon) [*Green*] , N.-W. Provinces [*Giles*] ; Makerian (26-x-1900) (Hoshiarpur) [*Dr. Datta*] ; Makessar (Celebes) [*t. Walker*] ; Pampanga, Philippines [*Whitmore*], and Calcutta.

19. **C. imprimens** Wlk., 1861.

Pr. Linn. So. v, 144 ♀.

C. imprimiens Giles, Handbk., 2nd Ed., 411 ♀.

Described from Amboina. It does not figure in Theobald's Monograph, but he mentions it in the " Gen. Ins." (incorrectly) as *imprimiens*.

20. **C. infula** Theob., 1901.

Mon. Culic. i, 370 ♀.

Giles, Handbk., 2nd Ed., 407 ♀.

A unique, from Taipang, taken by Mr. Wray jun. The usual two dates are added by Theobald (22-xi-1899 and 21-xii-1899) that appear to attend all species taken by this collector.

21. **C. japonicus** Theob., 1901.

Mon. Culic, i, 385 ♀.

Theob. Mon. Culic., iii, 158.
? *Culex aureostriatus* Doles.

Described from a series of ♀ ♀ from Japan. Theobald says it appears in June and July (Monog. i, 386), although the only date he gives in that work is that of the Tokio examples (March).

LOCALITIES : Peradeniya (Ceyl.), 1 ♀, October [*Green*] ; Tokio (8-iii-1899) [*Woods*].
N.B.—Doleschall's species is from Amboina.

22. **C. longipalpis** Wulp, 1892.

Mid. Sum. Dipt. 9 ; pl. i, 3, head.
Giles, Handbk., 2nd Ed., 423 ♀.

Described from 2 ♀ ♀ from Soeroelangoen (Sumatra).

23. C. longipes Theob., 1901.

Mon. Culic., ii, 68 ♀.
Giles, Handbk., 2nd Ed., 468 ♀.

Described from a unique taken by Hanitsch in a house at Singapore, 4-ix-1899. Since recorded from Singapore, July 27th.

24. C. luteolateralis Theob., 1901.

Mon. Culic., ii, 71 ♂ ♀ ; pl. xxvii, 108 ♀, full ins. col.
Giles, Handbk., 2nd Ed., 448 ♂ ♀.

LOCALITIES: Perak [*Wray*]; Pampanga (Phil. Is.) [*Whitmore*]; Manila, "fairly abundant" [*Banks*]. Also in January at Durban and in March in Mashonaland.

25. C. mediolineatus Theob., 1901.

Mon. Culic., ii, 113 ♀
Giles, Handbk., 2nd Ed., 431 ♀.

A unique ♀ in the British Museum from Thayetmyo (Upper Burma) [*Watson*].

26. C. microannulatus Theob., 1901.

Mon. Culic., i, 353 ♂ ♀ ; pl. xviii, 69 ♀, full ins. col.; fig. 118*b*, head; *d* fore ungues ♂.

Described from a good series from South India taken by James. A vicious biter, breeding in brackish water near Manila and Cavite, and allied closely to *vishnui* Theob., *sitiens* Wied., and *impellens* Wlk.

LOCALITIES: Quilon, 7-iii-1900 [*James*]; Madras [*Cornwall*]; N.-W. Prov., "common" [*Giles*]; Shahjahanpur (December) [*Giles*]; Mukerian (Hoshiarpur) [*Dr. Datta*]; Peradeniya (Ceyl.) [*Green*]; Manila [*Banks*]; Cavite (Phil. Is.), close to Manila [*Stiff*]; Pangasinan (Phil. Is.) [*Chamberlain*]; also from Calcutta and the Federated Malay States.

27. C. mimeticus Noe, 1899.

Bull. Ent. So. Ital., xxxi, 240.

Giles, Handbk., 2nd Ed., 389; pl. xv, 16, wing ♀; 17 palpi and proboscis ♂; 18 tarsal claws ♂.
Theob. Mon. Culic., i, 329 ♀; pl. xvi, 63 ♀; full ins. col.
? *hyrcanus* Pallas, Reisen Russ. Reich (1871), near Caspian Sea.

The larva has been observed in Cyprus. Giles says it "appears common in the hills of India, especially in the Nilgiri Hills, and also appears in the plains in the cooler season."

LOCALITIES: Punjab in March, 6,000 ft. [*Lindesay*]; Canara District [*Aitken*]; Theog (Simla Hills, 8,000 ft., 2-v-1907) [*Annandale*]; Kuala Lumpur [*Durham*]; Perak [*Wright*].

28. C. nigripes Zett., 1838-1840.

Ins., Lapponica, 807.

Culex nigripes Ficalbi (1896), Bull. So. Ent. Ital., 292.
Id. id. Theob. Mon. Culic., ii, 93 ♂ ♀; fig. 194, wing, ungues; ii, fig. 260 (p. 219) map of distribution.

An arctic species spreading out around the North Pole to about 35° latitude, occurring in Lapland, Greenland, Alaska, Hudson's Bay and many parts of North America, possibly also, California; its bite being said to be almost poisonous.

NOTE 1.—*Culex impiger* Wlk., List Dipt. Br. Mus. i, 6, is regarded by Theobald (Gen. Ins., p. 27) as synonymous with *nigripes* Zett., but Giles considers that it is but *pipiens* L. For wing scales see Theob. Monog.; pl. D (*impiger* Wlk.).

NOTE 2.—*Culex implacabilis* Wlk., List Dipt. Br. Mus., i, 7, is given as a synonym of *nigripes* in the Gen. Ins. (p. 27).

Dr. Neve took *nigripes* Zett. (21-viii-1899) on the Deosai Plateau between Kashmir and Shardo at an altitude of over 13,000 feet.

NOTE 3.—*Culex incidens* Thoms. (Eugenie Reise 443) was queried by Theobald in the 1st volume of his monograph as *nigripes* Zett., but in the 3rd volume (p. 193) he definitely decides that they are both distinct. This latter is not oriental.

29. C. pallidithorax Theob., 1905

Jour. econ. biol., i, 32.

India.

(?) 30. C. pipiens Linn., 1758.

Sys. Nat. Ed., x, 602.

Sch. F. Austr., ii, 628.
(For synonyms *vide* Theob. Gen. Ins. Fasc. 26.)

I do not add all the European references and synonyms to this common and typical species of the family, as it appears to me not to occur in the Orient at all.

Patton records it breeding in springs, wells and rainwater pools round D'thala and Jehag (Arabia), at an altitude of 7,000 feet, but the only claim it has to being an oriental species is the Padre Casto Elera's "Cat. de toda la faunna Filip." (1895), ii, 490, which includes it as part of the Philippine fauna; as, however, no one else has verified the species as from this region, I include it in my catalogue with a query.

NOTE.—Prof. Kertesz's Catalogue has *Culex domesticus* Germar (1817, Reise nach Dalmatien, 290) as a good species from South

Europe and the Orient, but Theobald (Gen. Ins., p. 28) sinks it as a synonym of *pipiens* L. It seems strange that a species quite common over the greater part of Europe and North America besides other regions, should be absent entirely from all parts of the Oriental Region. Possibly Theobald's *quasipipiens* may be an oriental form of this species.

31. **C. pulchriventer** Giles, 1901 (emendation mihi).

Jour. Bomb. So., xiii, 608 (*pulcriventer*).

Theob. Mon. Culic., ii, 48 ♂ ♀, pl. xxiii, 92 ♀, full ins. col.; fig. 170 ♂ ♀, abdominal segments, wing scales and ungues; fig. 172, wing ♂; fig. 171, wing ♀; fig. 173, larva.

Giles, Handbk., 2nd Ed., 449 ♂ ♀; pl. xvii, 1, claws, *a*, venation, *b*, head ♂, *c*, abdomen ♀, *d*, abdomen ♂, *e*, larva.

The larva has been observed by Giles in June at Naini Tal, where it breeds in clean water pools in the course of hill torrents. A sylvan species.

32. **C. pullus** Theob., 1905.

Ann. Mus. Hung., iii, 87 ♀, fig. 6, head.

Type in Hungarian Museum (a unique). Taken by Biro at Muina in Papua.

33. **C. quasipipiens** Theob., 1901.

Mon. Culic., ii 136 ♀, fig. 223, head, wing veins.
Giles, Handbk., 2nd Ed., 438.

"Very near *pipiens* L., but differs in the venation, and in the form of the head scales, which are smaller in that species; and in the larger thoracic scales" (Theob.).

LOCALITY: Sambalpur (Cent. Prov., India) [*Murphy*].

34. **C. quasiunivittatus** Theob., 1901.

Mon. Culic., ii, 32 ♀, fig. 164, head.

Near *univittatus*. Described from a unique female from Mashonaland, taken in February, but Banks now records it from Pampanga in the Philippines [*Whitmore*].

35. **C. reesii** Theob., 1901.

Mon. Culic., ii, 145 ♂ ♀; fig. 232 palpus ♂, thorax ♀, ungues ♂.

Giles, Handbk., 2nd Ed., 449 ♂ ♀.

Described from 2 ♂ ♂ and 2 ♀ ♀ in Dr. Rees's collection taken by him in October at Hongkong. "Very near *pipiens*."

36. C. rizali Banks, 1906.

Phil. Jour. Sci., i, 999 ♀.

Very near *japonicus* Theob. Described from two ♀ ♀. Type in Entomological Collection (No. 6083), Bureau of Science, Manila.

Taken on Negros Island (Philippines) by Banks in June, on the Siya Siya Mt. of the Canlaon Volcano.

37. C. rubrithorax Macq., 1850.

Dip. Exot. Supp., iv, 9 ♀.

Theob. Mon. Culic., i, 416 ♀, fig. 150, thorax, head apex, abdomen.
Giles, Handbk., 2nd Ed., 412 ♀.
Id. Jour. Trop. Med., vii, 368.
Skuse, Pr. Linn. So. N. S. Wales (1896), p. 1735.

Type in Paris Museum. At one time it was considered a spotted variety of *concolor* R. Desv., but in the " Gen. Ins." Theobald ranks it as distinct. It has been more than once incorrectly referred to as *rubithorax*. Really an Australian species, but Whitmore has taken it at Pampanga (Philippines).

38. C. sericeus Theob., 1901.

Mon. Culic., ii, 147 ♀; fig. 233, palpus, wing scales, cross veins, scutellum, thorax scale.
Giles, Handbk., 2nd Ed., 452 ♀.

Described from a unique ♀ in Dr. Rees's collection taken by him at Hongkong during October.

39. C. sitiens Wied., 1828.

Auss. Zweifl., i, 542 ♀.

Theob. Mon. Culic., i, 360, fig. 121, wing, proboscis.
Giles, Handbk., 2nd Ed., 400 ♀.

Theobald cannot trace the type, which, when Wiedemann described it, was in Dr. Trentepohl's collection. Several species are closely allied to this, *microannulatus*, for one. Giles records it as from Taiping, but gives no exact data.

40. C. tigripes de Grandpre and de Charmay 1900.

Planters' Gazette Press.

Giles, Handbk., 2nd Ed., 407 ♂ ♀; pl. xvi, 4, wing ♂ ♀; head ♂, thorax var.
Id. Jour. Trop. Med., vii, 368.
Theob. Mon. Culic., iii, fig. 120, 121, 122, larva, pupa diagrams.

Culex maculicrura Theob., 1901, Mon. Culic., ii, 34 ♂ ♀; pl. xxii, 85 ♀, full ins. col.

First described from Mauritius. Theobald, in a footnote on same page, confirms *maculicrura* as synonymous.

LOCALITIES: Dindings in December (Straits), Pampanga (Phil. Is.) [*Whitmore*]; also Mauritius, West Africa, Natal, Queensland.

41. **C. tipuliformis** Theob., 1901.

Mon. Culic., ii, 327 ♀; fig. 306, wing, leg, abdomen.
Giles, Handbk., 2nd Ed., 443 ♂.

" A very distinct species, its long legs giving it the appearance of a Tipulid " (Theob.) Described from a single female taken by Lindesay in March at Bakloh (N.-W. Prov., India), 5,000 ft.

42. **C. trimaculatus** Theob., 1905.

Ann. Mus. Hung., iii, 86 ♀; fig. 5, thoracic marks.

A unique. Type in Hungarian Museum. Bombay [*Biro*].

43. **C. uncus** Theob., 1901.

Mon. Culic., ii, 53.
Giles, Handbk., 2nd Ed., 452 ♀.

In plantains in Klang Jungle (Straits).

44. **C. univittatus** Theob., 1901.

Mon. Culic., ii, 29 ♂ ♀, fig. 161, head, abdomen, leg; pl. xxii, 86 ♀, full ins. col.

Giles, Handbk., 2nd Ed., 428 ♂ ♀ (*univitatus*, lapsus).

A vicious biter. Really an African species, but Hanitsch has taken it at Singapore. It occurs there in July and September.

45. **C. vagans** Wied., 1828.

Auss. Zweifl., i, 545 ♀.

Theob. Mon. Culic., i, 411 ♀, fig. 146, wing, scutellum.
Giles, Handbk., 2nd Ed., 414 ♀; pl. xvi, 14, venation ♀.
Id. Jour. Trop. Med., vii, 368.

The species does not appear in the " Gen. Ins." Theobald's description of it is from a single ♀ in Giles's coll.

LOCALITIES: Hongkong (October) · Shanghai [*Lindesay*]: Pampanga (Phil. Is.) [*Whitmore*].

46. C. viridiventer Giles, 1901.

Jour. Bomb. So., xiii, 609.

Theob. Mon. Culic., ii, 128 ♂ ♀, fig. 219, ungues ♂ ♀, abdominal segs., wing scales, ♂ palpus and proboscis; fig. 220, larva; pl. xxix, 116 ♀, full ins. col.
Giles, Handbk., 2nd Ed., 445 ♂ ♀; pl. xvii, 12, claw ♂, venation, abdomen, larva.

A sylvan species, bred by Giles in June and July at Naini Tal (7,000 ft.) from larvæ from pools which were open to great floodings by torrents, the recorder noting that it was difficult to understand how the larvæ could maintain their position.

LOCALITIES: Naini Tal, Katmandu (Nepal) [*Ind. Mus. Coll.*].

47. C. vishnui Theob., 1901.

Mon. Culic., i, 355 ♂ ♀, fig. 119, ungues, wing tips; fig. 120, wing ♀, 120*a* three forms of abdomen ♂ ♀; ungues ♂; pl. xvii, 66 ♀, full ins. col.
Giles, Handbk., 2nd Ed., 399 ♂; pl. xvi, 5*a* abdomen vars., 5*b* fore tarsal claws ♂.

Very near *microannulatus*. In rice fields at Sambalpur.

LOCALITIES: Sambalpur, 26-x-1900 (Cent. Prov., India) [*Murphy*]; Madras, Nov., Dec. [*Cornwall*]; Quilon, 27-vii-1900 and Feb. [*James*]; Ceylon, Nov. and 27-xii-1899 [*Bartholomew*], also Dacca.

CULEX spp.

Unrecognisable except from types.

48. C. doleschalli Giles, 1900.

Handbk., 1st Ed., 338.

nom. nov. for *cingulatus* Doles. 1856, Nat. Tijd. Ned. Ind., x, 405; pl. vii, 2; from Java. (*Culex id.*)

Cingulatus was preoccupied in *Culex* by Fabricius (1805 in Sys. Antl. 36) for a species from Brazil, the type being in Copenhagen Museum. Giles adds that it is very common all the year round in houses at Ambarawa (Java). Kertesz retains both Doleschall's and Fabricius's species under *cingulatus* (as two distinct species) without comment (Cat. Dipt., 1902).

49. C. filipes Wlk., 1861.

Pr. Linn. So. Lond., v, 229 ♀.

? = *molestus* Wied.

Type in British Museum, but too decayed to be recognisable. Described from Dorey (Papua).

50. C. luridus Doles., 1857.

Nat. Tijd. Ned. Ind., xiv, 384 ; pl. v, 1.
Giles, Handbk., 2nd Ed., 469.
? *inflictus* Theob., 1901, Mon. Culic., ii, 115.

Theobald ranks his *inflictus* as a good species (from Grenada) in "Gen. Ins.," but retains the queried synonymy with *luridus*.

"During dry season in houses" (Doleschall, referring to Java).

LOCALITY: Gombong, Mid-Java (*t. Doleschall*).

51. C. molestus Wied., 1821.

Dip. Exot., i, 39, and also Auss. Zweifl., i, 542.
Giles, Handbk., 2nd Ed., 470.

Type in Dr. Trentepohl's collection (defective), Sumatra.

52. C. setulosus Doles., 1857.

Nat. Tijd. Ned. Ind., xiv, 384 ; pl. v, 4.
Giles, Handbk., 2nd Ed., 470.

"During the dry season, in houses" (Doleschall), Mid-Java.

CULEX spp.

Not accounted for by Theobald in the "Genera Insectorum."

53. C. arabiensis Patton, 1905.

Jour. Bomb. So., xvi, 633 ♂ ♀ ; pl. D, ♂ palpus, ♂ clasper.

Found breeding in rainwater tank in May on the plain near Ulub Camp. Also found in the Crater, Aden.

54. C. aureostriatus Doles., 1857.

Nat. Tijd. Ned. Ind., xvi, 385 ♀ ; pl. vi, 1.
Theob., Mon. Culic., i, 387 ♀.

Included in Kertesz's "Cat. Dipt., i" ; but not in the "Genera Insectorum."

Doleschall describes it from Amboina, saying "in dwelling rooms."

Theobald queries it as a possible synonym of his *Culex japonicus*, but, pending a decision on its specific validity, I retain it as a separate species.

55. C. tritaeniorhynchus Giles, 1901

Entom., xxxiv, 192.
Jour. Bomb. So., xiii, 606.

Theob., Mon. Culic., i, 364 ♂ ♀, fig. 124, wing ♂ ♀.
Giles, Handbk., 2nd Ed., 401 ♂ ♀.

Theobald said (Monog., i) that he had not seen a specimen himself, but that he had seen a "rubbed example of *vishnui*" which had the appearance of *tritæniorhynchus*; repeating this opinion in Pr. Roy. So. Lond. (1902), p. 388; but he is silent on the species both in the 3rd volume of his Monograph and in the "Genera Insectorum."

LOCALITY: Travancore (South India).

56. C. ventralis Wlk., 1865.

Pr. Linn. So. Lond., viii, 103 ♀.

The second species of this name in *Culex* by Walker. Both species are given as distinct in Prof. Kertesz's Catalogue of Diptera, and the descriptions read distinct, but Theobald does not mention this second species; described from Papua. The other *ventralis* Wlk. (186 loc. cit. v, 144) is a synonym of *Desvoidya obturbans* Wlk.

TRICHOPRONOMYIA Theob., 1905.

Ann. Mus. Hung., iii, 98.

1. T. annulata Theob., 1905.

Ann. Mus. Hung., iii, 98 ♂, fig. 10 apex of proboscis, scales.

Type in Hungarian Museum (a unique).

LOCALITY: Friedrich Wilhelmshafen (Papua) [*Biro*].

TRICHORHYNCHUS Theob., 1905.

Jour. Bomb. So., xvi, 241.

1. T. fuscus Theob., 1905.

Jour. Bomb. So. xvi, 242 ♀; pl. A, fig. 2, head, palpus, clypeus, antenna, scutellum.

Described from a single perfect ♂ taken in December at Peradeniya (Ceylon).

TAENIORHYNCHUS Arrib., 1891.

Revista Mus. La Plata ii, 147, and Dipt. Argent, 47.

Tæniorhynchus as modified by Theob., 1901; Mon. Culic., ii, 190; also table of species.

Id. Giles, Handbk., 2nd Ed., 358.

Id. Theob. Gen. Ins. Fasc. 26, p. 30

The species in this genus are said to be mainly sylvan.

Prof. Goeldi has studied the life-history of *T. fasciolatus*, a South American species.

1. **T. acer** Wlk., 1848.

List. Dipt. Br. Mus., i, 8 ♀ (*Culex*).

LOCALITIES: Friedrich Wilhelmshafen, Mt. Hanseman (Astrolabe Bay) and Yomba, all in Papua, and taken by Biro. Also occurs in Queensland and New Zealand.

2. **T. ager** Giles, 1901.

Entom, xxxiv, 196 ♂ (*Culex bitæniorhynchus*), and
Jour. Bomb. So., xiii, 607 (*id. id.*).
Tæniorhynchus ager Giles in Theob., Mon. Culic., ii, 199 ♂ ; fig. 248, abdomen, palpus, proboscis, wing scales.
Id. id. Giles, Handbk., 2nd Ed., 365 ♂ ♀.

The larva occurs in rice fields, April and December being given as the periods when the imago appears.

LOCALITIES: Shahjahanpur, N.-W. Prov., Travancore, Ceylon, Madras [all *Giles*]; Madras [*Cornwall*].

3. **T. argenteus** Ludlow, 1905.

Can. Ent., xxxvii, 98 ♀.

Pampanga (Luzon) [*Whitmore*].

4. **T. aurites** Theob., 1901.

Mon. Culic., ii, 209 ♀; fig 253, proboscis, palpus, clypeus, scutellum, scales; fig. 254, wing, wing scales; pl. xxii, 88 ♀, full ins. col.
Giles, Handbk., 2nd Ed., 362 ♀.

Described from a series of ♀ ♀ in Dr. Annett's collection.

LOCALITIES: Dindings (December), Perak [*Wright*].

5. **T. brevicellulus** Theob., 1901.

Mon. Culic., ii, 212 ♂ ♀; fig. 255, wing (faulty), wing scales; fig. 256 ♂ ungues, ♂ palpus, ♂ antenna apex; pl. xxiii, 89 ♂ full. ins. col.; vol. iii, 268 corrects error in position of a vein in fig. 255, vol. ii.
Giles, Handbk., 2nd Ed., 363 ♀.

Described from 1 ♂ and 2 ♀ ♀ from Burmese and Malay localities.

LOCALITIES: Selangor, Perak, Thayetmyo (in August), Upper Burma.

6. **T. conopas** Frnfld., 1867.

Ver. zool. bot. Wien., xvii, 451.

Theob. Mon. Culic., ii, 202 ♂, fig. 249, wing, wing scales, scutellum ; pl. xxiii, 90 ♀, full ins. col. ; pl. E, wing scales.
Giles, Handbk., 2nd Ed., 360 ♂.

Described from a ♀ taken on board ship in the China seas.

LOCALITIES : Selangor 28-x-1899 [*Butler*] ; Kuala Lumpur (*Durham*) ; Perak [*Wray*] ; Formosa 8-i-1900 and June [*Ford*] ; also Dindings in June and December.

7. **T. lineatopennis** Ludlow, 1905.

Can. Ent. xxxvii, 133.

Described from 2 perfect ♀ ♀.

LOCALITIES : Bayembang in September (Pangasinan, Phil. Is.) [*Chamberlain*] ; Luzon.

8. **T. ochraceus** Theob., 1903.

Mon. Culic., iii, 263 ♀, fig. 140, scutellum.

Very near *aurites* Theob. Described from 2 perfect ♀ ♀ from Kuala Lumpur [*Dr. Durham*].

9. **T. tenax** Theob., 1901.

Mon. Culic., ii, 198 ♀ ; pl. xvii, 65, full ins. col.
Theob. loc. cit., iii, 259, fig. 236, wing.
Giles, Handbk., 2nd Ed., 365 ♀.

Very near *annulioris* Theob. The larva was found in springs and in the river by Patton in Arabia, from which land that author describes a variety as *maculipes arabiensis*.

LOCALITIES : Perak [*Wray, Wright*] ; Shaohyling (China) [*Cornford*] ; also from South and West Africa.

10. **T. whitmorei** Giles, 1904.

Jour. Trop. Med., vii, 367.

Pampanga (Phil. Is.) [*Whitmore*].

MANSONIA Blanchard, 1901.

Comp. rend. So. biol. Paris, xxiii, p. 1046.
nom. nov. for *Panoplites* Theob. preoc. Gould 1853 in Aves.

Panoplites Theob., 1901, Mon. Culic., ii, 173.
Mansonia Theob. 1903, Gen. Ins. Fasc. 26, p. 31.

1. M. annulifera Theob., 1901.

Mon. Culic., ii, 183 ♀ (*Panoplites*), fig. 224, wing; pl. xxx, 120 ♀, full ins. col.
Panoplites annulifera Giles, Handbk., 2nd Ed., 356 ♀; pl. xiii, 8, hind leg.
Mansonia id. Theob. Mon. Culic., iii, 274.

"Occurs all over India, the Malay Peninsula and East Indies." (Theob.)

LOCALITIES: Behar (Bengal) [*Lt.-Col. Macrae*]; Madras 12-xii-1899 [*Goodrich*]; Quilon [*James*]; Perak [*Wright*]; Singapore [*Durham*]; Ceylon [t. *Banks*]; Bayembang (Pangasinan, Phil. Is.) [*Chamberlain*]; Manila [*Banks*] and *Araneta*; also Dacca.

2. M. annulipes Wlk., 1857.

Pr. Linn. So. Lond., i, 6 ♀ (*Culex id.*).

Theob. Mon. Culic., ii, 185 ♀; pl. xxx, 119 ♀, full ins. col. (*Panoplites*).
Panoplites dives Giles, Handbk., 2nd Ed., 356 ♀.
Culex dives Sch. Reise Novara, 31.
Culex nero Doles. 1857, Nat. Tijd. Ned. Ind., xiv, 383; pl. v, 3.

Type in British Museum in fair condition. A common jungle species in the Straits; abundant at Perak.

Culex nero of Doleschall may not be synonymous, as that author says that his species is very troublesome in houses in Java, whereas *annulipes* is a sylvan species.

LOCALITIES: Selangor, 28-x-1899 and Sept. [*Butler*]; Perak, "very abundant nocturnal species" [*Wright*]; Dindings in Nov. and Dec. [*Wright*]; Kuala Lumpur [*Durham*]; Batavia [t. *Schiner*]; Rio Baco (Mindoro, Phil. Is.) [*McGregor*]; Gombong (Mid-Java) [t. *Doleschall*].

3. M. septempunctata, Theob., 1905.

Ann. Mus. Hung., iii, 107 ♀.

Type in Hungarian Museum.

LOCALITY: Friedrich Wilhelmshafen in November (Papua) [*Biro*].

4. M. uniformis, Theob., 1901.

Mon. Culic., ii, 180 ♀ (*Panoplites*); pl. xxx, 118 ♀, full ins. col.
Theob. Mon. Culic., iii, 270, fig. 144, pupa.
Panoplites africanus Theob., 1901 l.c., ii, 187.
Mansonia africana id. Gen. Ins. Fasc. 26, pl. ii, 6 ♀, full ins. col.

Panoplites australiensis Theob., in MS., Giles, Handbk., 2nd Ed., 355.
var. *reversus* Theob. Mon. Culic., ii, 189.
Panoplites uniformis Giles, Handbk., 2nd Ed., 353 ; pl. xiii, 3, venation ♂ ♀ , leptoaxis of wing vein, ♂ head.

Near *annulifera* Theob. and *titillans* Wlk. The most abundant species of the genus in the Philippines. An abundant species in South India, and occurs in the Malay Peninsula.

LOCALITIES : Shahjahanpur (N.-W. Prov., India) early Oct. [*Giles*] ; Quilon 7-iv-1900 [*James*] ; Taiping [*Wray*] ; Dilo, Friedrich Wilhelmshafen, and Ins. Graget (all Papua) [*Biro*] ; Bayembang, Pangasinan, Phil. Is. [*Chamberlain*] ; Manila, Rizal, Ft. McKinley [*Banks, Schultze, Craig, Araneta*].

MELANOCONION Theob., 1903.

Mon. Culic., iii, 238 ; pl. xii, wing scales.

Theob. Gen. Ins. Fasc. 26, p. 32.

Described by Theobald as " small black gnats which bite viciously, and which occur in swamps and woods."

1. M. ornatus, Theob., 1905.

Ann. Mus. Hung., iii, 100 ♀ .

Type (unique) in Hungarian Museum ; taken in December by Biro at Friedrich Wilhelmshafen in Papua.

2. M. pallidiceps Theob., 1905.

Ann. Mus. Hung., iii, 101 ♀ .

Type in Hungarian Museum. Taken at Friedrich Wilhelmshafen (Dec.) by Biro.

POPEA Ludlow, 1905.

Can. Ent., xxxvii, 95.

Miss Ludlow says " near *Finlaya* "; Banks quotes it, " *incerta sedis*."

1. P. lutea Ludlow, 1905.

Can. Ent. xxxvii, 96 ♂ .

A unique, perfect specimen taken amongst banana trees by Whitmore at Pampanga (Luzon, Phil. Is.).

FINLAYA Theob., 1903.

Mon. Culic., iii, 281 ; pl. xiii, wing scale.

Theob. Gen. Ins. Fasc. 26, p. 32.

1. **F. anopheloides** Giles, 1903.

Jour. Trop. Med. vi., 315 (*Mansonia id.*).

I follow Theobald in this, not having seen the above paper, but I have seen somewhere a reference to an *anopheloides* Thomson.

2. **F. aranetana** Banks, 1906.

Phil. Jour. Sci., i, 1001 ♂ ♀.

Types (♂ ♀) No. 6066 in Entomological Coll., Bureau of Science, Manila. The species breeds in water in the axils of banana leaves, and the adult does not bite. Taken at Bago (Negros Is.) in the Philippines during June at an altitude of 700 metres on the Siya Siya Peak of the Canlaon Volcano.

3. **F. flavipennis** Giles, 1904.

Jour. Trop. Med., vii, 366.

Not given in the Genera Insectorum by Theobald.
LOCALITY: Pampanga (Luzon) [*Whitmore*].

4. **F. kochi** Donitz, 1901.

Insectenborse, v, 38 ♀ (*Culex*).

Theobald's description of this species in Monog., ii, 217 is from a single damaged ♀, and he notes in vol. ii, that the erection of a new genus may be required for it, but in vol. iii he decides on *Finlaya*, and also retains it here in the " Gen. Ins."

5. **F. melanoptera** Giles, 1904.

Jour. Trop. Med., vii, 367.

Not mentioned by Theobald in the " Genera Insectorum."
LOCALITY: Pampanga (Luzon) [*Whitmore*].

6. **F. poicilia** Theob., 1903.

Mon. Culic., iii, 283 ♀, fig. 156, wing scales.
poial a Giles Jour. Trop. Med., vii, 366 (lapsus).

Described from a single, nearly perfect example.

" There is no species with which it can be confused." (Theob.)

" The ♂ will shortly be described in the " Entomologist." (Theob.)

" Bred from larvæ taken from banana trees." (Ludlow.)

LOCALITIES: Penang, 24-x-1907 [*Dr. Freear*]; Friedrich Wilhelmshafen, Seleo Berlinhafen, and Mt. Hansemann (Astrolabe Bay), all in Papua [*Biro*]; Pampanga (Luzon) [*Whitmore*]; Negros Is. (Phil. Is.) [*Banks*].

ORTHOPODOMYIA Theob., 1904.

Entom., xxxvii, 236.

"Near Finlaya."

1. O. albipes Leicester in Theob., 1904.

Entom., xxxvii, 237 ♂ ♀.

Described from examples taken by Dr. Leicester during April in bamboo jungle, 5 miles from Kuala Lumpur.

Type in British Museum.

NOTE.—Neither this species nor the genus are included in the "Gen. Ins."

REEDOMYIA Ludlow, 1905.

Can. Ent., xxxvii, 94.

Banks considers the genus of uncertain position in the family, including it, however, in the *Culicinæ*.

1. R. niveoscutellata Theob., 1905.

Jour. econ. biol., i, 22; pl. iii, 5.

India.

2. R. pampangensis Ludlow, 1905.

Can. Ent. xxxvii, 94 ♀.

Described from 3 ♀ ♀ "taken in the woods, and in the Military Quarters."

LOCALITY: Pampanga (Luzon), Sept. [*Whitmore*].

Sub. Fam. AEDEOMYINAE.

Table of Genera Giles, Handbk., 2nd Ed., 475.
Id. id. Theob. Gen. Ins. Fasc. 26, p. 34.

LEPTOSOMATOMYIA Theob., 1905.

Ann. Mus. Hung., iii, 80.

1. L. lateralis Theob., 1905.

Ann. Mus. Hung., iii, 110 ♂; fig. 13, head, scutellum, ungues.

Type in Hungarian Museum.

LOCALITY: Muina (Papua), Dec. 31st [*Biro*].

FICALBIA Theob., 1903.

Mon. Culic., iii, 296.
Theob. Gen. Ins. Fasc. 26, p. 36.

Allied to *Skusea*, *Verrallina* and *Uranotænia*.

1. **F. simplex** Theob., 1903.

Mon. Culic., iii, 297 ♂.

Described from a perfect, unique specimen, taken by Mr. Green in September at Kurunegalla (Ceylon).

2. **F. minima** Theob., 1901.

Mon. Culic., ii, 262 ♂ (*Uranotænia id.*) ; fig. 281, wing, costal border, wing scales.
Giles, Handbk., 2nd Ed., 488 ♂.

" A very distinct species " (Theob.). Described from 2 ♂ ♂.
LOCALITY : Quilon, 7-iii-1900 and Febr. (*James*).

ANISOCHELEOMYIA Theob., 1905.

Entom., xxxviii, 52.

Theobald says, " near *Uranotænia* " ; Banks says, " *incerta sedis.*"

1. **A. alboannulata** Theob., 1905.

Entom., xxxviii, 55.

India.

2. **A. (?) albitarsis** Ludlow, 1905.

Can. Ent., xxxvii, 131 ♀.

Described from a perfect unique. In all probability it belongs to this genus.
LOCALITY : Pampanga (Phil. Is.) [*Whitmore*].

URANOTAENIA Arrib., 1899.

Dipt. Argent. 63 (in Revista Mus. La Plata).

Theob. Mon. Culic., ii, 241, p. 241, head fig. ; p. 242 map of distribution ; p. 243 table of spp.; pl. D, wing scales.
Theob. Gen. Ins. Fasc. 26, p. 36.

1. **U. atra** Theob., 1905.

Ann. Mus. Hung., iii, 114 ♀.

Type in Hungarian Museum. Described from a unique.
LOCALITY : Muina (Papua) [*Biro*].

2. **U. caeruleocephala** Theob., 1901.

Mon. Culic., ii, 256 ; fig. 276, thorax, scutellum, head, scales.
var. *lateralis* Ludlow 1905, Can. Ent., xxxvii, 385 ♀.

Described from 8 ♀ ♀ in Dr. Annett's coll.

Of her variety Miss Ludlow remarks that if Theobald's type was a rubbed specimen it becomes her variety *lateralis*.

LOCALITIES : Cottabatto (Mindanao) (Phil. Is.) [*Vedder*]. Also Gambia, Sudan and old Calabar.

3. **U. falcipes** Banks, 1906.

Phil. Jour. Sci., i, 1004 ♂ ♀.

Types No. 5210 in Entomological Coll., Bureau of Science, Manila.

LOCALITY : Rizal (Manila), February [*Banks, Schultze*].

4. **U. malayi** Theob., 1901.

Mon. Culic., ii, 258.
Giles, Handbk., 2nd Ed., 494 ♀.

A unique.

LOCALITY : The jungle at Selangor, 28-x-1899 (Straits).

5. **U. nitidoventer** Giles, 1904.

Jour. Trop. Med., vii, 368.

Not given in the "Gen. Ins." by Theobald.

LOCALITY : Pampanga (Luzon) [*Whitmore*].

6. **U. testacea** Theob., 1905.

Ann. Mus. Hung.; iii, 113 ♀; fig. 14, basal seg. antennæ; pl. ii, wing; pl. iii, wing scales.

Described from two ♀ ♀. Types in the Hungarian Museum. Taken by Biro at Singapore.

MIMOMYIA Theob., 1903.

Mon. Culic., iii, 304.
Theob. Gen. Ins. Fasc. 26, p. 36.

Allied to *Uranotænia*. The larva of a Uganda species (*splendens* Theob.) has been observed by Dr. Low, and noticed to retain a position when in the water somewhat between that of *Anopheles* and *Culex* (*Theob.*).

1. **M. chamberlaini** Ludlow, 1904.

Can. Ent., xxxvi, 297 ♂.

Described from a unique ♂.

LOCALITY : Bayambang in Pangasinan (Phil. Is.), May [*Chamberlain*].

PHONIOMYIA Theob., 1903.

Mon. Culic., ii, 311; pl. xiv, xv (*Macrorhynchus longirostris* Theob.), wing scales ♂ ♀.

Theob. Gen. Ins. Fasc. 26, p. 38.

1. P. bimaculipes Theob., 1905.

Ann. Mus. Hung., iii, 114 ♀.

Described from 3 ♀ ♀ in the Hungarian Museum (types).

LOCALITIES: Moroka, July to Sept. (Papua), 1,300 metres alt. [*Loria*]; Friedrich Wilhelmshafen (Papua) [*Biro*].

2. P. indica Theob., 1905.

Ann. Mus. Hung., iii, 115 ♂ ♀; pl. ii, wing ♀, pl. iii, wing scales ♀.

Types in Hungarian Museum. Theobald says "described from a perfect ♂, but though in his description of the species he does not mention the ♀ (unless the abbreviated diagnosis of 6 lines is intended to apply to both sexes) he figures a ♀ wing in pl. ii.

RUNCHOMYIA Theob., 1903.

Mon. Culic., iii, 319.
Theob. Gen. Ins. Fasc. 26, p. 38.

"Near *Dendromyia*."

1. R. philippinensis Giles, 1904.

Jour. Trop. Med., vii, 368.

Not accounted for in the "Gen. Ins." by Theobald.

LOCALITY: Pampanga (Luzon) [*Whitmore*].

WYEOMYIA Theob., 1901.

Mon. Culic., ii, 267: vol. iii, 310 (restricted).
Theob. Gen. Ins. Fasc. 26, p. 38.

1. W. aranoides Theob., 1901.

Mon. Culic., ii, 274 ♀.
Giles, Handbk., 2nd Ed., 499 ♀.

Straits. A unique, damaged, but Mr. Theobald believes it belongs to this genus.

2. W. greenii Theob., 1905.

Jour. Bomb. So., xvi, 247 ♂ ♀; pl. B, 5, antenna.

Described from a perfect ♂ and ♀. The species is ignored in the "Gen. Ins." There is a *Howardina greenii* Theob. also from Peradeniya in February, but that appears to be a different species

POLYLEPIDOMYIA Theob., 1905.

Ann. Mus. Hung., iii, 118.

Near *Dendromyia* and *Phoniomyia.*

1. P. argenteiventris Theob., 1905.

Ann. Mus. Hung., iii, 118 ♀, fig. 15, head, scutellum, bristles.

Described from 5 ♀ ♀. Types in Hungarian Museum.

LOCALITY: *Paumomu* River (Papua) [*Loria*].

HEINZMANNIA Ludlow, 1905.

Can. Ent., xxxvii, 130 (*Heizmannia*).

Heinzmannia (Ludlow), Banks, Phil. Jour. Sci., i, 99 emendation from *Heizmannia* Ludl. (lapsus).

"Near *Dendromyia* Ludlow: incerta sedis." (Banks.)

1. H. scintillans Ludlow, 1905.

Can. Ent., xxxvii, 130 ♀.

LOCALITY: Pampanga (Phil. Is.).

AEDEOMYIA Theob., 1901.

Mon. Culic., ii, 218; fig. 259, scales; f. 260, map of distribution.

Theob. Gen. Ins. Fasc. 26, p. 35.

1. squamipenna Arrib., 1878.

El. Nat. Argent., i, 151 (*Aedes squammipennis*).

Aedes squammipenna Arrib. 1891. Dip. Argent., 62.
Aedeomyia squammipenna Theob. Mon. Culic. ii, 219 ♂ ♀; fig. 261, leg tuft, wing fringe, apex ♂ antenna, ungues ♂ ♀; pl. xxxi, 124 ♀, full ins. col.; pl. E, wing scales, ol. iii, 307.
Id. *squammipennis* Theob. Gen Ins. Fasc. 26; pl. ii, 9 ♀ full ins. col.
Id. *id.* Giles, Handbk., 2nd Ed., 479.

A slightly variable species, whose bite is not severe. Common at Manila.

LOCALITIES : Madras [*Cornwall*] ; Perak [*Wray*] ; Seleo Berlinhafen and Friedrich Wilhelmshafen (Papua) [*Biro*] ; Manila [*Banks, Schultze, Woolley*] ; Ceylon. Also South America, West Indies and the Sudan.

AEDES Meig., 1818.

Sys. Besch., i, 13.
Sch. F. Austr., ii, 630.
Ficalbi Bull So. Ent. It. (1896), p. 299.

1. butleri Theob., 1901.

Mon. Culic., ii, 230 ♀.
Giles, Handbk., 2nd Ed., 481 ♀.

Theobald is uncertain if the species truly belongs to this genus. Described from Selangor, " Jungle ; common and troublesome."

HODGESIA Theob., 1904.

Jour. Trop. Med., vii, 17.

1. H. sanguinea Theob., 1904.

Jour. Trop. Med., vii, 17.
Giles, Jour. Trop. Med., vii, 368.

Mr. Theobald considers the position of this genus uncertain, but he includes it in the *Aedeomyinæ*. Described first from Uganda, and said to be an annoying bloodsucker.

LOCALITIES : Angeles (Pampanga, Phil. Is.) [*Whitmore*] ; Luzon.

Sub. Fam. CORETHRINÆ.

Giles, Handbk., 2nd Ed., 500.

CORETHRA Meig., 1803.

Illig. Mag., ii, 260.

Meig. Sys. Besch., i, 14.
Macq. Hist. Nat., i, 47.
Sch. F. Austr., ii, 623.
Wulp, Dip. Neer., 331.
Theob. Mon. Culic., ii, 288, figs. 294, 295, various parts.
Id. id. i, 34 *et seq.*, larva and pupa desc. and fig.
Id. Gen. Ins. Fasc. 26, p. 42.
Giles, Handbk., 2nd Ed., 501 : table of spp.

The larvæ live in almost any water, but prefer clear water (Theob.). The proboscis is not formed for biting, and they occur usually in the open country or in woods.

1. **C. asiatica** Giles, 1901.

Entom., xxxiv, 196 ♀.
Theob. Mon. Culic., ii, 294 ♀; fig. 296, wing, thorax.
Giles, Handbk., 2nd Ed., 506 ♀.

Described from a single ♀ in Giles's coll. taken in a house.
LOCALITY: Shajahanpur (N.-W. Prov., India) [*Giles*].

SAYOMYIA Coq., 1903.

Can. Ent., xxxv, 189.

Syn. *Corethra* Loew, *non* Meig.

1. **S. manilensis** Sch., 1868.

Reise der Novara Dipt. 30 ♂ (*Corethra id*).
Corethra maniliensis Th. Mon. Culic., ii, 300 (Sch.'s desc. transl.).
Coreth. manillensis Giles, Handbk., 2nd Ed., 504 (Sch.'s descr. transl.).
Sayomyia manilliensis Th. Gen. Ins. Fasc. 26, p. 43.

Manila.

2. **S. cornfordi** Theob., 1903.

Mon. Culic., iii, 339 ♀ (*Corethra id.*).

Described from several ♀ ♀.
LOCALITY: Shaohyling (China) in May and June [*Cornford*].

ETORLEPTIOMYIA Theob., 1905.

Gen. Ins. Fasc. 26, p. 44.

Banks places this in his *Corethrinæ*, adding "*incerta sedis.*"

1. **E. luzonensis** Ludlow, 1905.

Can. Ent., xxxvii, 101 (*Oreillia id.*).
Etorleptiomyia id. Ludlow Can. Ent., xxxviii, 185.

Bayembang (Pangasinan, Phil. Is.) [*Chamberlain*].

RACHIONOTOMYIA Theob., 1905.

Jour. Bomb. So., xvi, 248.

1. R. ceylonensis Theob., 1905.

Jour. Bomb. So., xvi, 248 ♀; pl. B, 6, scutellum.

Described from a perfect unique. This genus possesses a peculiar scutellar process that differentiates it from all others, and Mr. Theobald seems to regard it as holding an isolated position.

Peradeniya, Ceylon (Oct.).

INDEX.

* * * *

* * * *

* * * *

NOTES ON THE ORIENTAL SYRPHIDÆ.

By E. BRUNETTI.

PART I.

[Owing to delay in the receipt of the MS. it has been found necessary to postpone the publication of this paper until the next number of these "Records" appears. As the plates have been already printed, however, they are issued now, with the Author's bare references to the figures.—ED.]

EXPLANATION OF PLATES XI, XII AND XIII.

PLATE XI.

FIG. 1.—*Paragus luteus*, Bru., sp. nov., ♀.
,, 2.—*Eriozona ruficauda*, Bru., sp. nov., ♀.
,, 3.—*Baccha robusta*, Bru., sp. nov., ♂ ♀. Abdomen.
,, 4.— Id. Head.
,, 5.—*B. nigricosta*, Bru., sp. nov. Wing.
,, 6—*B. tinctipennis*, Bru., sp. nov. Wing.
,, 7.—*Rhingia laticincta*, Bru., sp. nov. ♂ ♀. Abdomen.
,, 8.— Id. var. ♂ ♀. Abdomen.
,, 9.—*Volucella nubeculosa*, Macq. Abdomen.
,, 10.— Id. Wing.
,, 11.—*V. basalis*, Bru., sp. nov., ♀. Abdomen.
,, 12.— Id. Wing.
,, 13.—*V. ruficauda*, Bru., sp. nov, ♂ ♀.
,, 14.—*Lycastris albipes*, Wlk. ♂.
,, 15.— Id. Wing.
,, 16.—*L. flavohirta*, Bru., sp. nov., ♂. Abdomen.
,, 17.— Id. Wing.

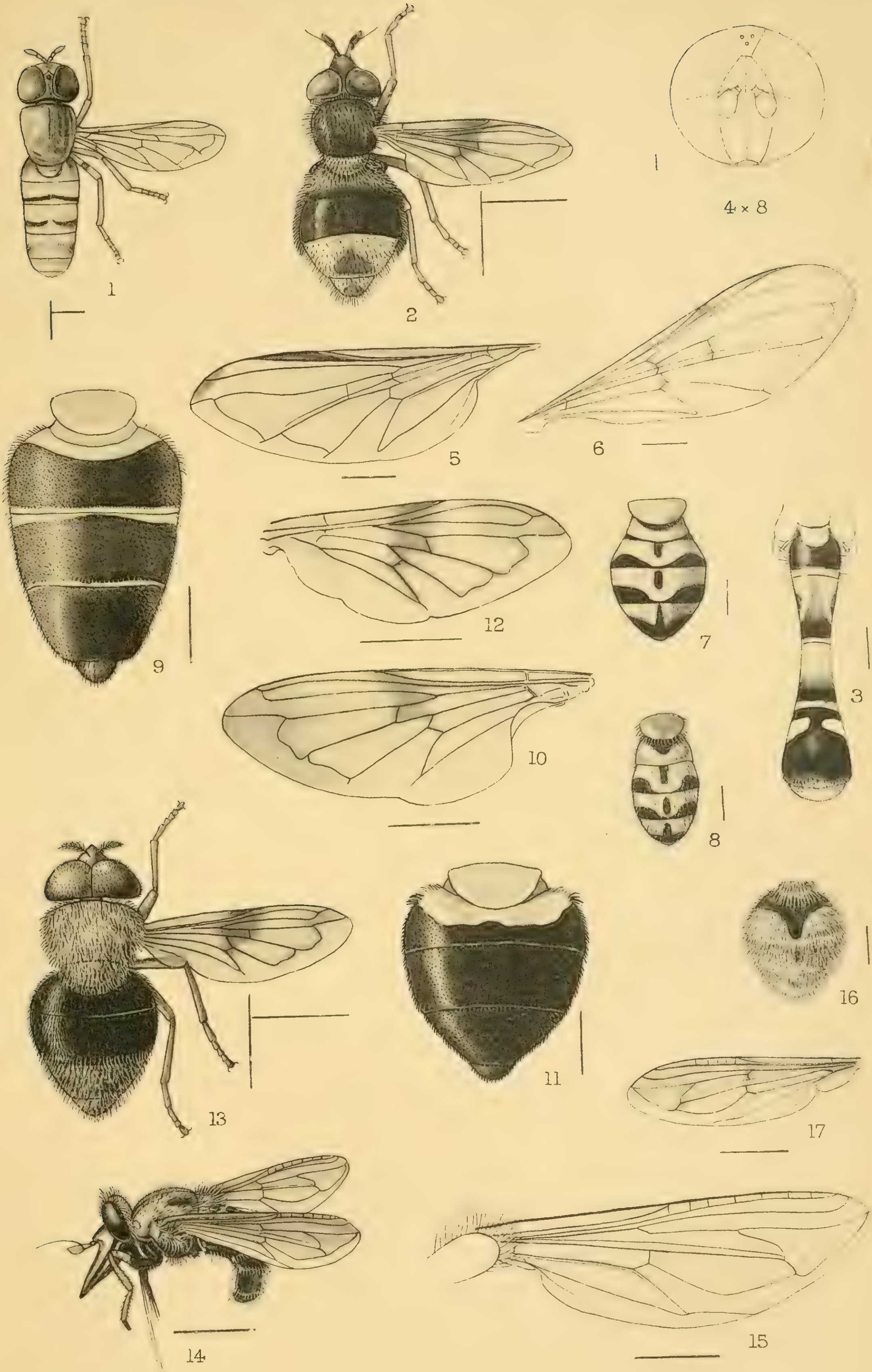
PLATE XII.

FIG. 1.—*Helophilus quadrivittatus*, Wied., ♂. Abdomen.
,, 2.— Id. ♀. Id.
,, 3.— Id. var. ♀. Id.
,, 4.—*H. bengalensis*, Wied. ♂. Id.
,, 5.— Id. ♀. Id.
,, 6.— Id. var. ♀. Id.
,, 7.—*H. insignis*, Dol ♂. Id.
,, 8.— Id. ♀. Id.
,, 9.— Id. Posterior leg.
,, 10.—*H. sp.* ? ♀. Abdomen.

Fig. 11.—*H. sp.* near *pilipes*, Dol. ♂. Abdomen.
,, 12.— Id. Anterior, middle and posterior leg.
,, 13.—*H. sp.*, ♀. Abdomen.
,, 14.— Id. Anterior middle and posterior leg.
,, 15.—*H. aënous*, Bru., sp. nov., ♀.
,, 16.—*H. tuberculatus*, Bru., sp. nov., ♂ ♀. Abdomen.
,, 17.— Id. Middle leg.
,, 18.—Bigot's "*H. pilipes*, Dol.," ♂. Abdomen in profile.
,, 19.— Id. Anterior leg.
,, 20.— Id. Middle leg.
,, 21.—*H. sp.*, ♀. Abdomen.

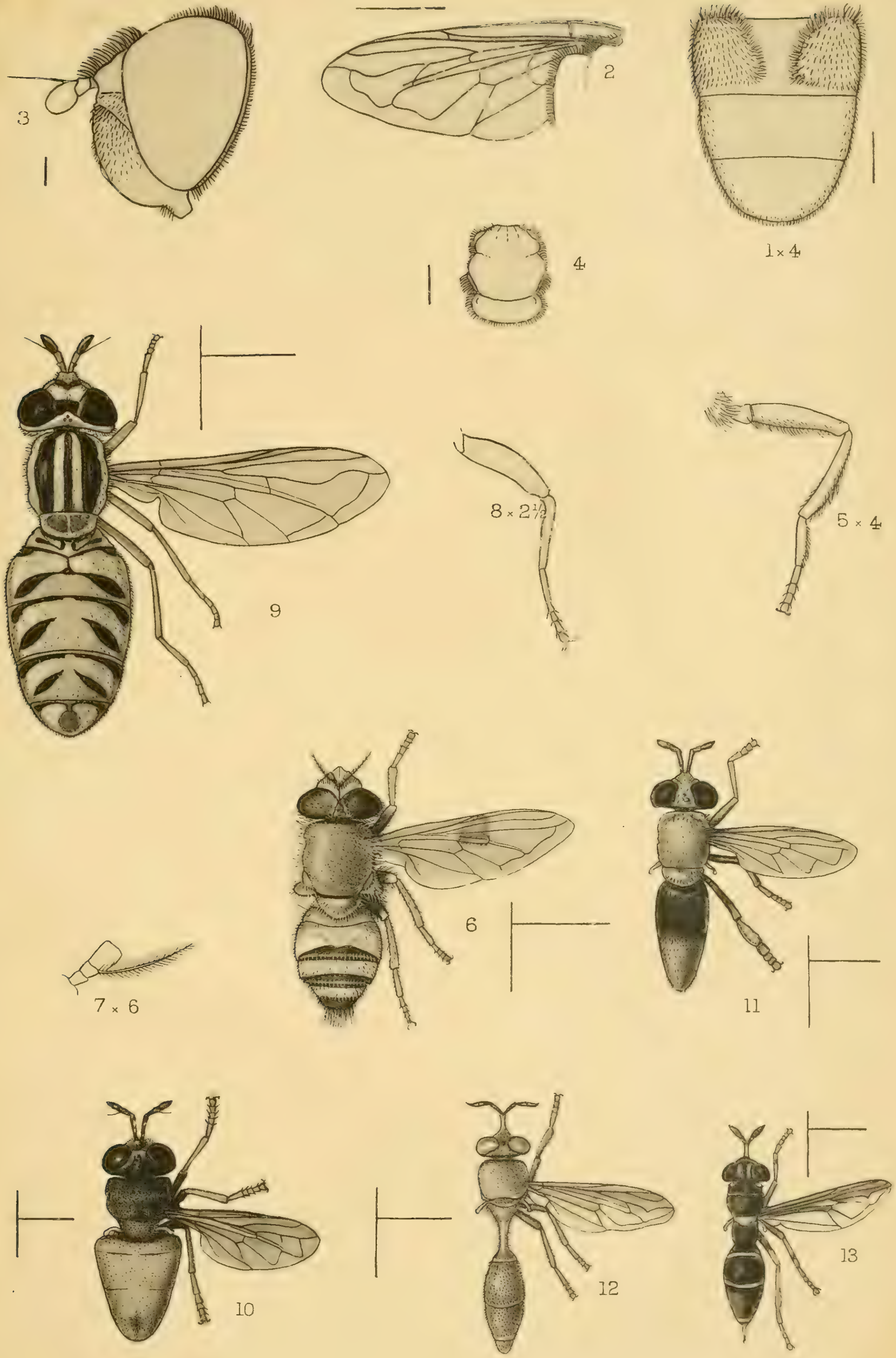
PLATE XIII.

Fig. 1.—*Azpeytia bifascia*, Bru., sp. nov., ♂. Abdomen.
,, 2.— Id. Wing.
,, 3.— Id. Head.
,, 4.— Id. Thorax and scutellum.
,, 5.— Id. Posterior leg.
,, 6.—*Sericomyia himalayensis*, Bru., sp. nov., ♂.
,, 7.— Id. Antenna.
,, 8.— Id. Posterior leg.
,, 9.—*Chrysotoxum sexfasciatum*, Bru., sp. nov., ♀.
,, 10.—*Microdon annandalei*, Bru., sp. nov., ♂.
,, 11.—*M. ruficaudus*, Bru., sp. nov., ♀.
,, 12.—*Ceria obscura*, Bru., sp. nov., ♀.
,, 13.—*C. compacta*, Bru., sp. nov., ♀.



A. C. Chowdhary, del.

ORIENTAL SYRPHIDÆ.



A. C. Chowdhary, del.

ORIENTAL SYRPHIDÆ.

XXVI.—NOTES ON ORIENTAL DIPTERA.

IV.—ON SOME INDIAN SPECIES OF *LIMNOPHORA* AND *ANTHOMYIA*, WITH A DESCRIPTION OF A NEW SPECIES OF THE FORMER GENUS.

By E. BRUNETTI.

While passing through Lucknow in April last Dr. Annandale found a small, well-marked, black-and-grey Anthomyid fly very common and troublesome in houses, having apparently supplanted the common *Musca domestica*, although a species of *Musca* closely allied to *M. domestica*, but I think distinct, also occurred.

On reference to descriptions I identified the Anthomyid, with very little doubt, as the *Anthomyia tonitrui* of Wiedemann. It would, however, now be placed in the more modern genus *Limnophora*. The species is evidently widely distributed in the East. I found it common at Mhow, Central India, in the middle of April, 1905; in this locality it used to rest, motionless, on the flowerpots in an open-air conservatory, seldom on the plants themselves. At Mussoorie, towards the end of June, 1905, I also found it common in a churchyard garden full of clover, in company with the ordinary European dung fly *Scatophaga stercoraria* L., a species of *Chortophila*, and a small Tachinid.

I have no doubt that the *A. lobalis* of Thomson from China is the same species, my specimens answering even better to this description than to that of *tonitrui*; and as Thomson himself says it is closely allied to Wiedemann's species, the identity of the two is practically assured.

I give a full description, which has been drawn up from a considerable number of freshly captured and well preserved specimens from various localities.

Limnophora tonitrui Wied. (Plate xv; fig. 1, ♂; fig. 2, ♀.)

Anthomyia tonitrui, Wied. Aus. Zweifl., ii, p. 429.

? *Anthomyia lobalis*, Thoms. Eugenie Reise, p. 551.

Head shining silvery grey, vertex and antennæ black, frons in ♀ with a broad central black stripe, bearing a row of strong hairs on its borders, bending strongly inwards; mouth with stiff bristles of different lengths; the posterior orbit of the eyes entirely encircled by similar bristles; eyes subcontiguous in the ♂, just below the lengthened triangular vertex, separated only by the frontal white ocular orbit; proboscis short, thick, black; palpi not apparent.

Thorax ash-grey, with, on the front border, two black spots joined together; a wide jet-black transverse band across the mesothorax, reaching the wing-insertions, where it is slightly produced posteriorly; scutellum unicolorous, basal half black. The whole thorax and scutellum beset with isolated long stiff bristles, including two longer ones at the tip of the scutellum. Sides of thorax whitish grey, with some stiff bristles.

Abdomen pale yellowish; first segment semi-transparent, with an oblong black spot on the posterior border towards each side that is often indistinct or nearly absent; second and third segments with a long linear spot on each side of the posterior border and a small oval spot in the centre of the foreborder; fourth segment ash-grey, with two round black spots in the centre, these spots much wider in the ♀. Belly yellowish white, blackish at tip. Dorsum of abdomen with soft black hair, which is also present at the sides of the segments while at each side on the posterior border of each segment, placed at the extreme edge, are two long black bristles posteriorly deflexed.

Legs black or dark brown; anterior femora curved, with a row of stiff hairs on the upper side and another row on the outside; middle femora with a row of very short hairs below and a few on the upper side and one or two long bristles at the tip; posterior femora very slightly curved, with a row of stiff hairs on the outer side above and on the inner side below; tibiæ practically bare, with a few spiny bristles at the tip; tarsi simple.

Wings clear; the third and fourth longitudinal veins distinctly converging at the tip (as in *Hydrotæa*) but at the extreme tip the fourth slightly deflexed; the internal cross vein placed at two thirds of the distance from the base of the discal cell; external cross vein nearly or quite straight, distant its own length from the internal cross vein and half its length from the wing border. Three or four short, stiff bristles at the extreme base of the costa; alulæ white, iridescent, the lower scale much the larger; halteres pale yellowish.

Described from 5 ♂ ♂ in the Indian Museum collection taken by Dr. Annandale in houses at Lucknow on April 21st, 1907, and from a considerable number of specimens of both sexes taken by me at Mhow, Central India, between April 11th and 16th, 1905, and at Mussoorie between June 20th and 24th, 1905. A ♂ from the Gonda district, Central India, taken between March 3rd and 5th, 1907, is also in the Indian Museum.

Limnophora himalayenis, sp. nov., mihi. (Plate xv, fig 3, ♀.)

♀. This species is allied to the preceding one but quite distinct; it differs from *L. tonitrui* in the following characters:—

The abdominal marks consist of a pair of well separated spots in the centre of the posterior part of each of the first three segments, the first pair small and round, the second elongated, triangular in shape and placed lengthwise, with the bases of the spots approximate, the third similar but rather shorter ; fourth segment with a row of four bristles.

Minor characters concern the frontal black spot, of which the upper margin takes the form of a V ; also the scutellum, of which only the extreme base is black, whilst the black band in front of it is narrower.

Described from 3 ♀ ♀ in the collection of the Indian Museum, two taken by Dr. Annandale between the 28th and 30th of April, 1907, at Theog (alt. 8,000 feet) in the Simla district, and one from Dharampur in the same district (alt. 8,000 feet), taken between May 6th and 8th.

Types in Indian Museum collection.

NOTE.—The other species of *Limnophora* recorded up to the present from the East are—

L. bengalensis, R. Desv. Essai sur les Myodaires, 518. Bengal.
L. macei, R. Desv. Loc. cit., 519. Bengal.
L. prominens, Stein. Tijd. voor Ent., xlvii, 106. Java.
L. nigripennis, Stein. Loc. cit., 108. Java.

Anthomyia pluvialis, L. (Plate xv, fig. 6, ♀.)

A single male of this pretty species was taken by Dr. Annandale at Theog on May 2nd this year. It is very common throughout Europe and North America, and probably occurs right across the Palæarctic region to Japan and China, and may perhaps be found at many places in the Himalayas. I believe it has not been recorded from India before.

Anthomyia bisetosa, Thoms. (Plate xv ; fig. 4, ♂ ; fig. 5, ♀.)

Anthomyia bisetosa, Thoms. Eugenie Reise, p. 555.

Described first in the "Eugenie Reise" from China (♀), this species has come under my notice several times lately. I took it myself at Mhow, 11th to 16th April 1905, and at Hongkong, 5th March 1906, whilst the Indian Museum possesses specimens from Calcutta taken in May this year. The appearance of the thorax of this species is the same as that of the two species of *Limnophora* described above, while the abdomen is similar to that of *A. pluvialis* ; it is very distinct, and I do not think there can be much doubt about the identification of the species with that of Thomson.

Head—

In the male : eyes separated by only the narrowest possible silver-white dividing line, extending to the vertex ; lower part of face greyish white, more or less silvery seen from above, with, on each side of the lower part of the cheeks, a triangular black spot bearing one strong bristle and some smaller ones ; antennæ black, arista bare ; a row of bristles along under part of head ; vertex very small with some long bristles; back of head grey, with a single row of small bristles round the eye border. In the female the front equals one third the width of the head, silvery grey, with a quadrate black spot, sometimes appearing as a thick V, just above the antennæ; on either side of this spot is a vertical row of four bristles.

Thorax—

Ash-grey, lower part rather more whitish, a deep black broad stripe runs transversely across the dorsum from the wing-insertions, and a narrower one immediately in front of the scutellum. The disposition of bristles is not quite consistent, but seems to be as follows: a lateral row of three large ones on the humeral limit of the dorsum; a transverse row of eight bristles immediately in front of the transverse black stripe, of which the two centre ones are smaller than the rest; a row of six then follows, and in front of these again, a rather irregular row of quite small ones of varying number; three or four occur on the black stripe, and between it and the scutellum are ten or twelve others. The unicolorous scutellum bears a few short ones and two long ones at the tip which cross one another; a row of five bristles in front of each wing-insertion with three or four behind; metanotum whitish grey, bare.

Abdomen—

Whitish grey; at the base of the second, third and fourth segments a narrow black band which is produced downwards in the form of three triangles, the centre ones being longest and narrowest, the outer ones not reaching the posterior border, nor the side margins. A row of bristles on posterior edge of each segment, the dorsum of which is covered with scattered hairs. Belly grey.

Legs—

Black; femora with a row of bristly hairs on outer and under sides, longest on fore pair; four posterior tibiæ with a few scattered bristles. Hind femora curved, ♂ ♀.

Wings—

Pale grey, with the slightest yellowish tint towards base and foreborder; alulæ whitish, lower scale slightly the larger; halteres pale yellow.

Described from six males and four females in the Indian Museum collection, from Calcutta, May 1907, Mhow (India), 11th to 16th April 1905, Hongkong, 5th March 1906, and from further specimens of both sexes from Mhow and Hongkong in my own collection, the specimens from these two localities having been taken by me.

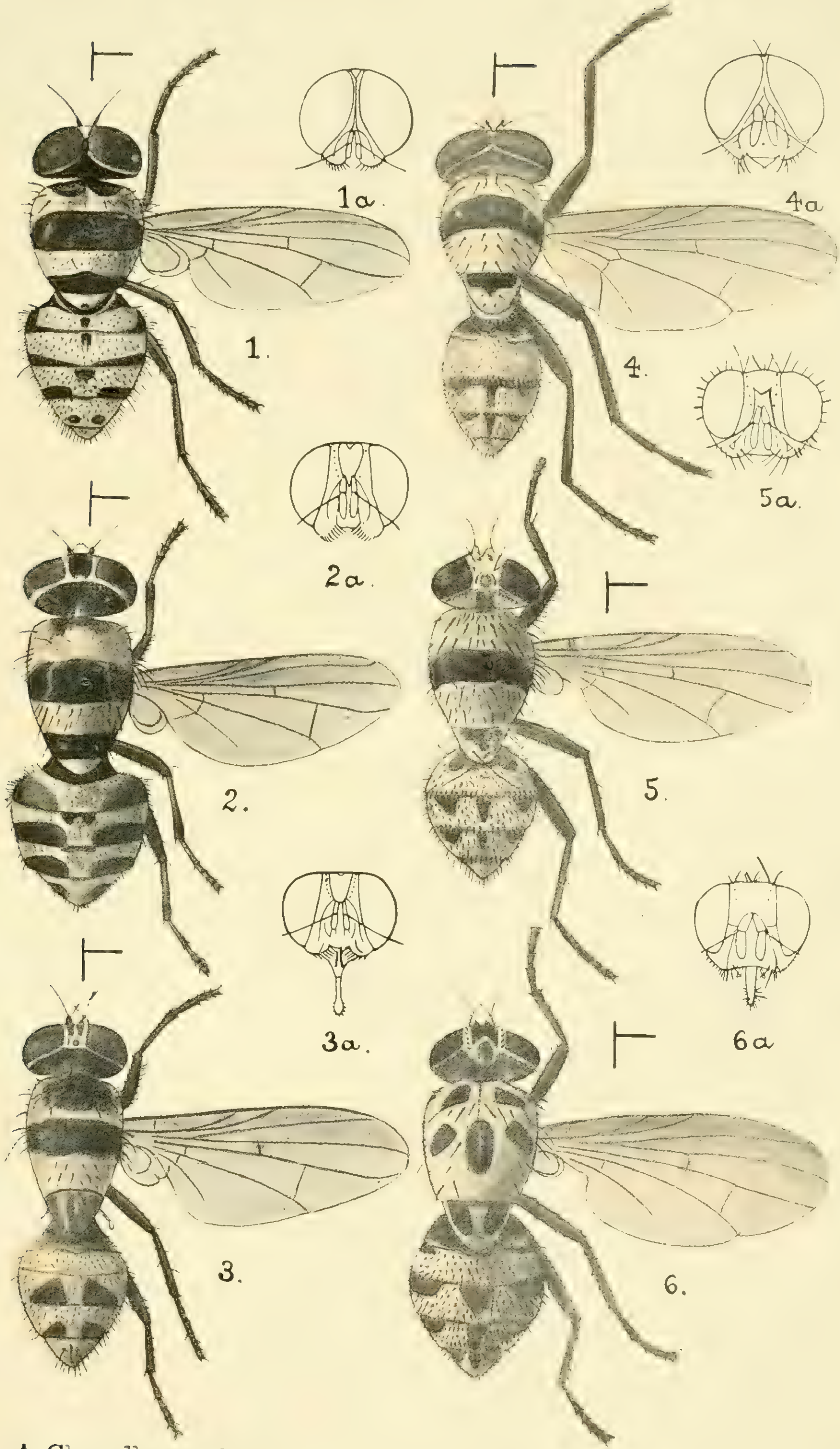
NOTE.—These four species stand out as conspicuous ones, amongst the generally sombre coloured Anthomyids, yet, although in general appearance resembling one another, they can all be easily recognized.

In Van der Wulp's Catalogue of South Asian Diptera, only nineteen species are given, and to these no new ones have since then been added. Of these, *tonitrui*, Wied., is a *Limnophora*, as herein shown ; *albicornis*, Wlk., is referred by Kertesz to *Mydæa* ; *peshawarensis*, Big., is considered by Künckel d'Herculais (to whom co-types have been sent from the Indian Museum) as synonymous with *Chortophila cilicrura*, Rond. ; whilst the remainder may be roughly separated into four groups : A (arista bare ; legs black), B (arista bare ; legs more or less pale), C (arista plumose ; legs black), D (arista plumose ; legs more or less pale). A few species in which the arista is minutely pubescent are, as is usual in these cases, classed with those which have the arista bare.

Group A. *metallica*, Wied. ; *exigua*, Wied.
Group B. *bina*, Wied. ; *flexa*, Wied. ; *manillensis*, Frfld. (V. d. Wulp's quotation as to page is incorrect ; it should be 449).
Group C. *calens*, Wied. ; *concana*, Wlk. ; *lenticeps*, Thoms.
Group D. *quadrata*, Wied. ; *bibax*, Wied. ; *trina*, Wied. ; *peræ*, Wlk.

The two remaining species I cannot place, as their author gives no information regarding the pilosity or otherwise of the arista. They are *illocata*, Wlk., and *procellaria*, Wlk.

Probably some of the above species belong to the more recently established genera, but this is not the place to deal with the question, nor have I the means at hand to form any opinion on the matter.



A. Chowdhary, del

XXVII.—NOTES ON FRESHWATER SPONGES.

By N. ANNANDALE, *B.A.*, *D.Sc.*, *Superintendent, Indian Museum*

VI.—THE MIDDAY SIESTA OF *Spongilla* IN THE TROPICS.

During last winter I was able to keep specimens of *Spongilla c assissima* and *S. proliferens* alive for some weeks in an aquarium. Accidentally, while attempting to demonstrate the currents set up in the water by their activity, I discovered that for some hours in the middle of the day these currents ceased. During their cessation the oscular collars were considerably contracted but not altogether closed, but I have been able to obtain no evidence that the cells that surround the inhalent pores have the power of contraction at all well developed. The cessation of the currents can, therefore, have been due only to cessation of movement on the part of the flagellæ of the collar cells. It is by no means uncommon for cœlenterates to remain in a state of quiescence during the heat of the day in the tropics and even in temperate climates, and it is not surprising that sponges should follow the same course. The great majority of the organisms found in ponds in Lower Bengal appear to be adversely affected by heat and, as it were, imperfectly acclimatized. Winter is the only time at which many of them flourish, although this is by far the driest season in Calcutta, and the majority are most active in the evening and early morning.

VII.—DESCRIPTION OF TWO NEW FRESHWATER SPONGES FROM EASTERN BENGAL, WITH REMARKS ON ALLIED FORMS.

The two new sponges here described were found at Rampur Bhoolia (Rajshahi), Eastern Bengal, in February last. Both of them were abundant on reeds and twigs, together with *Spongilla carteri*, Bowerbank, in several ponds near the European quarter of the town.

Spongilla reticulata, (?) sp. nov.

Subgenus *Euspongilla*, Vejdovsky.

Sponge soft, consisting of a thin layer incrusting the support, and of numerous transversely elongated, laterally compressed, delicate branches, which frequently anastomose so as to form a reticulated structure. Colour bright green. Surface smooth, minutely hispid; oscula surrounded by conspicuous membranous collars, which are supported by a delicate ring of spongin; pores minute. Primary radiating fibres of skeleton delicate, feebly coherent, never with more than a few spicules parallel to one another, secondary (transverse) fibres barely distinguishable as such, irregular; the whole skeleton extremely fragile, spongin being present in exceedingly small quantities. Skeleton spicules smooth, moderately stout, comparatively large, ampioxous, gradually pointed ; flesh spicules numerous both in the dermal membrane and in the parenchyma, slender, abruptly pointed or blunt, curved in a wide arc or nearly straight, covered irregularly with relatively large spines, which tend, especially towards the ends of the spicule, to be bent backwards and inwards ; gemmule spicules closely similar but stouter. Gemmules large, spherical, yellow, abundant, both in the basal layer and in the branches, covered with a thick layer of granular substance, which is confined externally by a definite chitinous coat ; the gemmule spicules arranged horizontally in the latter and tangentially on the former ; the single aperture infundibular, not provided with a chitinous tube.

This Sponge is closely related to the very variable species *Spongilla alba*, Carter, from which it may be distinguished by its external form, by the presence of green bodies in the cells of its parenchyma, and by its soft consistency and fragile skeleton.

Spongilla alba [1] is, again, very closely allied to *S. lacustris*,[1] of which *S. reticulata* may be no more than a specialized race. An examination of a considerable number of specimens from different parts of Bengal convinces me that the only constant differences between *S. alba* and *S. lacustris* are the following :—

Spongilla alba.	*Spongilla lacustris.*
Branches frequently absent, when present, laterally compressed. Colour even in a bright light, white or grey, occasionally dark green owing to the presence in the tissues of extracellular algæ.	Branches rarely absent, when present, cylindrical. Colour, in a bright light, leaf-green owing to the presence of chlorophyl corpuscles in cells of the parenchyma.

The skeleton is also stouter in *S. alba* than in *S. lacustris*, and this is perhaps the most important difference.

Differences in external form and in colour are by no means satisfactory foundations for the creating of species in the Spongillinæ as a rule. The latter is liable to change from a variety of causes, *e.g.*, leaden-grey examples of *Ephydatia indica* become white if kept alive in an aquarium, and it is well known that the chlorophyl corpuscles, which probably start life as independent organisms, become colourless if kept in the dark or even in a dull light. As regards the presence of such bodies in *S. lacustris*, however, and their absence from *S. alba*, it is not sufficient to suppose that the free-living organism does not occur in the

[1] Petr differentiates between the two forms (in Bohemian) in *Abh. Böhmisch Ges.*, viii, p. 27, pl. i. Unfortunately I am unable to read what he says. His figures of the gemmules are clear, if somewhat diagrammatic, but do not, of course, illustrate their range of variation. (Lately I have found the typical *S. lacustris* in W. India. Dec., 1907.)

water of Indian ponds, for the "corpuscles" are found not only in the closely allied *S. reticulata* but also in *S. proliferens*, a form that I have frequently taken in the same pond as *S. alba*. Some peculiarity, structural or physiological, in the cells of the parenchyma is argued by their absence from *S. alba*. Both *S. lacustris* and *S. alba* vary greatly in external form; but it is noteworthy that not only is *S. alba* far more frequently devoid of branches than *S. lacustris*, but in the latter the branches appear never to show any tendency to be laterally compressed—the shape they always take in *S. alba*, if they are present at all. Very often they occur in this species merely as ridges or irregular projections on the surface, but frequently they are well developed. Gemmules of *S. lacustris* generally have a chitinous cup surrounding the aperture; such a cup is sometimes present in those of *S. alba* but often completely absent.

For these reasons I think it advisable to regard *S. alba* conventionally as a species distinct from *S. lacustris*, of which, however, it is a close ally.

My *S. lacustris* var. *bengalensis* is a synonym of *S. alba*, between the typical form of which and Bowerbank's *S. cerebellata* I can draw no line, although Carter recognized *S. cerebellata* as a variety of his species. The arrangement, as well as the proportions, of the gemmule spicules differs even in different gemmules of the same specimen, and I find that flesh spicules are often present in one part of a sponge and absent from another.

Specimens of *S. alba* were obtained during winter in salt water in the Chilka Lake, Orissa, by Babu Gopal Chandra Chatterjee, who has presented them to the Museum. They form a thin layer, without a trace of branches, on and between the shells of mussels (*Mytilus striatulus*), are devoid of flesh spicules and have larger and stouter skeleton spicules than any other form of the species with which I am acquainted. Their finder tells me that they were white in life. I name this form provisionally *S. alba* var. *marina*, but it is possible that it is only a temporary phase. In the Port Canning ponds *S. alba* (*bengalensis*) was devoid of branches in the winter of 1905-1906, but was profusely branched in the succeeding cold weather, all the individuals of the first phase having died down in the intervening seasons. It is worthy of note that *S. alba* resembles *S. lacustris* not only in its structure and its variability, but also in being able to live in salt water, a medium in which the latter species has frequently been found in the Northern Hemisphere.

Spongilla crassior, sp. nov.

Subgenus *Spongilla*, Wierzejski.

Sponge incrusting its support in a thin layer, very hard and firm, of a yellowish colour, the external surface smooth, without projecting spicules, the oscula situated on star-shaped areas, the pores minute. Both vertical and transverse fibres of the skeleton extremely massive, especially so (but irregularly arranged) towards the external surface; a large amount of spongin present in the skeleton. Skeleton spicules short, stout, smooth, straight or nearly straight, abruptly rounded at the ends, but often with a very slender and minute terminal projection; no flesh spicules; gemmule spicules slender, cylindrical, amphistrongylous, nearly straight, uniformly covered with minute blunt spines; arranged in distinct layers, one of which lies horizontally on the external surface of the gemmule group, while the other is situated, with the spicules lying tangentially, immediately outside each gemmule. The gemmules small, spherical, grouped together in groups of various sizes; the "cells" surrounding them large, polygonal in cross section, in many layers; the main aperture of each gemmule provided with a long, trumpet-shaped, curved tubule, which opens outwards; subsidiary apertures sometimes present. The gemmules occupying the whole of sponge except a thin external layer, in which the interstices of the skeleton are small.

In external appearance this species closely resembles *S. fragilis*, Leidy, a form widely distributed in Europe and America, recorded from Australia, and lately found by myself in the Museum tank in Calcutta, in which it was growing (together with *S. alba*, *S. carteri*, *Ephydatia fluviatilis* var. *meyeni*, *Trochospongilla phillottiana* and *T. latouchiana*) on a brick wall. *Spongilla crassior* is, however, most nearly related to my *S. crassissima*, but its skeleton spicules are stouter. The four Indian representatives of the subgenus are all very close to one another, and I have had much difficulty in separating them. As three of them are common in Calcutta and I have, therefore, been able to examine a considerable number of specimens, I think the following key will be found useful in distinguishing them :—

SUBGENUS *Spongilla* (GEMMULES BOUND TOGETHER IN GROUPS, EACH OF WHICH IS ENCLOSED IN A MASS OF POLYGONAL "CELLS").

A. *Gemmule spicules apparently not arranged in two layers* –

a. Skeleton spicules amphioxous; fibres of skeleton delicate—*Spongilla decipiens*, Weber.

B. *Gemmule spicules clearly arranged in an outer and an inner layer*—

b. Framework of skeleton not very stout; skeleton spicules amphioxous; sponge incrusting—*Spongilla fragilis*, Leidy.

b'. Fibres of skeleton moderate, forming a close, hard reticulation; sponge forming spherical or spindle-shaped masses—*Spongilla crassissima*, mihi.

b^2. Fibres of skeleton extremely massive, especially towards the external surface, skeleton spicules sausage-shaped, sponge incrusting—*Spongilla crassior*, sp. nov.

Weber says in his original description of *S. decipiens* that the gemmule tubules are short and straight, but I do not find this feature to be constant in Indian specimens. In the same gemmule group, indeed, short, straight tubules and long curved ones often occur, and although Potts states that in *S. fragilis* the tubules are of equal diameter throughout, I cannot regard this character as of specific value by itself, for in all the species of the subgenus as yet recorded from India the outline of the tubules is frequently irregular. My examples of *S. fragilis* differ from the figures of palæarctic specimens in having stouter skeleton spicules, some of which are pointed so abruptly that they are almost amphistrongylous.

I now see reason to regard my *S. crassissima* var. *bigemmulata* not as a true variety but as a temporary phase of the species. I have only found it at the beginning of the cold season, that is to say, at a date at which the typical *S. crassissima* is still rare, and the very numerous amphioxi and comparative looseness of the skeleton in all my specimens point to immaturity. In several other species, notably in *S. carteri*, I find that the skeleton is less compact at the beginning of the season than it afterwards becomes, although I also find that in *S. carteri* the strengthening of the skeleton, due chiefly to the development of the transverse fibres, does not go so far in some ponds as in others in the same neighbourhood. Indeed, I feel confident in stating, after examining a large number of examples of this species *in situ* in different ponds in Calcutta at different times of the year, and on single occasions at Rajshahi and Lucknow, that the strength of the skeleton is correlated, whether fortuitously or not I cannot as yet say, with the character of the vegetation of the pond; examples from ponds in which Phanerogamic plants are few, have, towards the end of the cold weather, comparatively stout skeletons, whereas those from ponds in which such plants grow luxuriantly, are fragile even at this date; specimens from both are fragile during the hot weather and the rains—seasons during which few individuals of *S. carteri* are found alive and gemmules are rarely formed. Specimens of this species taken at these seasons are, moreover, as a rule smooth and rounded on the surface, with the exhalent apertures few, large and very deep. They are of a pale flesh-colour, rarely tinged with green in life, and have the peculiar property of turning spirit a dark brown and becoming brown themselves in alcohol, a property I have not seen in specimens taken at other times of the year. Although the majority of "hot-weather" specimens are of this form, I have, however, taken others of a more typical one even at this season.

Ephydatia indica also shows seasonal variation as regards its skeleton spicules, which in May are pointed and irregularly inflated, and in July and August are blunt at the extremities and much more nearly regular in outline; gemmules are found at both seasons but their spicules likewise differ in shape (*Rec. Ind. Mus.*, i, part 3, p. 273).

There can be no doubt, therefore, that considerable seasonal variation occurs in the freshwater sponges of the Ganges delta, and, indeed, this might have been expected from the plastic nature of these organisms and the wide range of temperature to which they are exposed in a district on the verge of the tropics.

REFERENCES.

Carter, H. J. .. "History, etc., of known species of *Spongilla*," *Ann. Mag. Nat. Hist.* (5), vii, p. 77 (1881).

Potts, E. .. "Contributions towards a Synopsis of the American Forms of Freshwater Sponges," etc., *Proc. Acad. Sci. Philadelphia*, xxix, p. 159 (1887).

Weber, M. .. "Spongillidæ des Indischen Archipels," *Zool. Ergebnisse einer Reise in Niederlandisch Öst Indien*, vol. i, p. 30 (1890).

Weltner, W. .. "Die Süsswasserschwämme," in Zacharias, *Die Tier- und Pflanzenwelt des Süsswassers*, vol. i, p. 187 (1891).

Weltner, W. .. "Spongillidenstudien, III," *Archiv f. Naturgesch.*, lxi, p. 114 (1895).

Annandale, N. .. "Notes on the Freshwater Fauna of India, No. IX," *Journ. Asiat. Soc. Bengal*, 1907, p. 5.

Annandale, N. .. "The Fauna of Brackish Ponds at Port Canning, Lower Bengal, Part I," *Rec. Ind. Mus.*, i, p. 37 (1907).

EXPLANATION OF PLATE XIV.

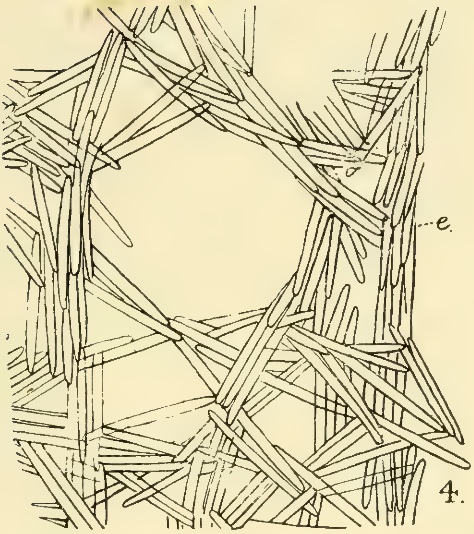
FIG. 1.—*Spongilla reticulata*, (?) sp. nov. (from a dried specimen) nat. size.

FIG. 1a.— ,, ,, ,, ,, gemmule spicules, highly magnified.

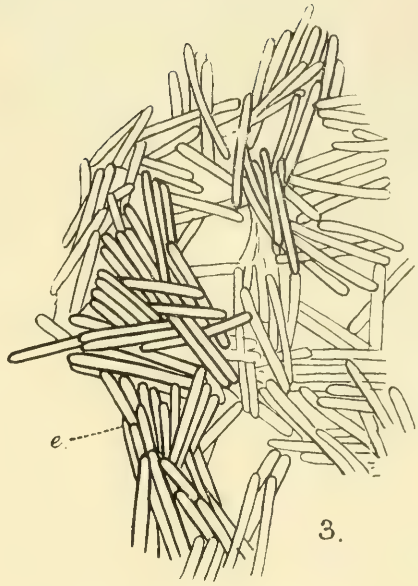
FIG. 2.— ,, *alba*, Carter, gemmule spicules (both from the same specimen) at the same magnification.

FIG. 3.— ,, *crassior*, sp. nov., portion of the skeleton near the external surface, magnified (e=external surface).

FIG. 4.— ,, *crassissima*, Annandale, ditto.

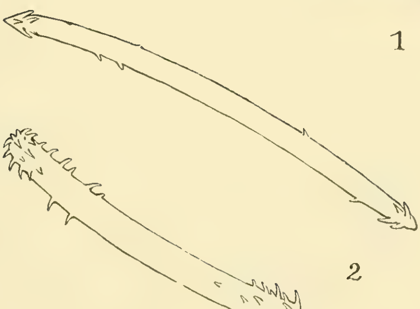


4.



3.

1



2

1a.

A. Chowdhary, *del.*

Engraved and Printed

XXVIII.—DESCRIPTION OF A NEW CYPRINID FISH OF THE GENUS *DANIO* FROM UPPER BURMA.

By C. TATE REGAN, *M.A.*

Danio browni, sp. nov.

Depth of body $2\frac{2}{3}$ to $3\frac{1}{5}$ in the length; length of head 4. Snout from nearly as long as to a little longer than the diameter of eye, which is $3\frac{1}{4}$ to $3\frac{3}{4}$ in the length of head; interorbital width $2\frac{1}{4}$ to $2\frac{1}{3}$ in the length of head. Four barbels, the anterior pair $\frac{1}{2}$ to $\frac{2}{3}$ the diameter of eye, the posterior pair much shorter; maxillary extending to the vertical from anterior edge of eye; suborbitals completely covering the cheek. Thirty to 34 scales in a longitudinal series, $6\frac{1}{2}$ to $7\frac{1}{2}$ in a transverse series from origin of dorsal to lateral line, 1 or 2 between lateral line and base of ventral fin. Dorsal of 2 or 3 simple and 9 or 10 branched rays; origin equidistant from vertical limb of præoperculum and base of caudal. Anal of 2 simple and 11 or 12 branched rays; origin below the middle of the dorsal. Pectoral not quite reaching the ventrals. Three to five dark bluish longitudinal lateral stripes, the middle one of which broadens out anteriorly and usually becomes double, forming a loop on the middle of the side above the ventral fins, whilst the stripe below curves upwards in front of the loop.

Hab. Northern Shan States, Upper Burma.

Nine specimens, the largest 70 mm. in total length, collected by J. Coggin Brown.

This species is near to *D. kakhiensis*, Anderson, in which the body is more slender (depth $3\frac{1}{3}$ to $3\frac{2}{3}$ in the length), the mouth is more vertical and the first suborbital consequently much larger, and the middle lateral stripe does not broaden out or form a loop anteriorly.

MISCELLANEA.

REPTILES AND BATRACHIA.

A COLOUR VARIETY OF *Typhlops braminus*.—A peculiar *Typhlops* was brought to me some months ago by one of the Museum servants, who had caught it in Calcutta. Thinking that it probably represented a new species, I sent it to Mr. G. A. Boulenger for description. He tells me, however, that he believes it to be *T. braminus*. The whole of the body is of a bright bluish grey, which in life was almost blue, the head and the tip of the tail being white. A similar specimen was recently sent to the Museum from Sirsiah, Mozufferpore, Bihar, by Mrs. Bergtheil, but has unfortunately been mislaid.

N. ANNANDALE.

REPTILES AND A BATRACHIAN FROM AN ISLAND IN THE CHILKA LAKE, ORISSA.—In August, 1907, the Museum Collector, Mr. R. A. Hodgart, spent a week on Gopkuda Island, which lies about a mile and a half from the shore in the Chilka Lake, a large, shallow lagoon recently (from a geological point of view) separated from the Bay of Bengal on the coast of Orissa. The lake is not completely shut off from the sea, for a narrow channel still persists; during the rains the water is rendered brackish by the large amount of fresh water brought into it by the small streams that terminate in the lake, but during winter it becomes much salter. The following reptiles and frog were obtained on Gopkuda Island by Mr. R. A. Hodgart :—

1. *Emyda vittata*, Peters.

Three half-grown specimens from the shores of the island. As I have already pointed out (*Journ. Asiat. Soc. Bengal*, 1906, p. 203), this form is no more than a race of *E. granosa*, Schoepff, the typical form of which apparently replaces it in the valleys of the Ganges and the Indus. Two of the three specimens have an irregular reticulation of narrow dark lines on their carapace—a common feature of the form—and all have longitudinal dark lines on the head and neck.

2. *Hemidactylus frenatus*, D. and B.

A single male with two longitudinal rows of pink spots on the ventral surface of the tail. The species occurs all over Bengal.

3. *Hemidactylus brookii*, Gray.

A single male with fourteen præanal pores—not an unusual number—on either side.

4. *Calotes versicolor* (Daud.).

One young specimen.

5. *Varanus nebulosus* (Gray).

One small specimen.

6. *Typhlops acutus* (D. and B.).

One small specimen.

7. *Cerberus rhynchops* (Schneid.).

A specimen was caught off the island holding a small horse-mackerel (*Caranx ire*) by the belly in its jaws.

8. *Rhacophorus maculatus* (Gray).

A single specimen, taken on the wall of a house.

N. ANNANDALE.